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ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

1188 - Encouragement in the Growing of the Castor-Oil Plant in Indo-China. — *Feuille d'Informations du Ministère d'Agriculture*, Year XXIII, No. 35, p. 8, Paris, August 27, 1918.

In order to encourage the cultivation of the castor-oil plant in Indo-China, the Governor General of the Colony issued a decree dated February 16, 1918, regulating the issue of advances to castor-oil plant growers for the duration of hostilities.

By this decree the advances may be issued in the form of seed or loans. The borrower must undertake to sell to the Supply Service the whole castor-oil crop grown on his land for the cultivation of which the advance was made. The Administration ascertains that the sums advanced are devoted exclusively to the cultivation of the castor-oil plant and verifies the condition of the crops. Supervision may continue until the grower has discharged his whole debt. A maximum is fixed for the advances made for acreage already in condition to be cultivated, and another higher one for land which has to be prepared.

1189 - Measures Taken by the Administration in Indo-China to Promote the Development of Sericulture. — See No. 1164 of this Review.

1190 - Native Agriculture in Cochin-China. — QUESNEL, P., in *Congrès d'Agriculture coloniale, Gouvernement général de l'Indochine*, Saigon Series, Bulletin No. 1, 46 pp. + 1 Plate. Saigon, 1918.

The Author (Civil Service Administrator and Inspector of Political and Administrative Affairs) draws attention to the fact that Cochin-China is a purely agricultural country with, it may be said, one crop — rice. Of

the 20 provinces of the colony, only 5, situated in the East (Basia, Bienhoa, Thudaumot, Tayniuls and Giadinh), are provinces in which rice can only be grown in the valleys; the rest of the land, more or less high, is covered with forests or bare plains on which stock find a scanty pasture. In these provinces, in either grey or red soil, are found the rubber plantations and it should be possible to grow other crops there as well.

In the 15 other provinces situated in the Delta of the Mekong, Vaïco or the Saigon River, rice is practically the sole crop. The natives only grow other products as secondary crops, on land sufficiently high to be free from floods, on the banks of the canals and the "giongs", large banks of sand formed by the sea. Coconut and betelnut are cultivated along the waterways, where the houses generally are, but only on a small scale.

Of a maximum of 3 500 000 inhabitants there are 240 000 Cambodians, 153 000 Chinese, 31 000 Mois (savages), 6 800 Malays, and 71 000 Minh-huongs (half-breeds of native and Chinese parentage). There are some hundred foreigners — Indians, Japanese, Burmese, Arabs, Bengalese. Of the 153 000 Chinese living in Cochin-China, 22 000 are at Saigon and 75 000 at Cholon-ville. There are 35 000 Annamites at Saigon and 38 000 at Cholon-ville. If the Minh-huongs are reckoned in with the Annamites there are 2 975 000 Annamites and 431 000 other Asiatics. This only makes 3 ½ million, but it must be remembered that many natives, like the Chinese, live without being registered anywhere so as to avoid paying taxes and, for this and similar reasons, the statistics supplied by the villages are always below the actual ones.

The author studies briefly these different classes of the population and shows that, without considering the Chinese, who are foreigners, the Annamite adapts himself best to our civilisation and our cultivation, that the Moï, although a savage, would also adapt himself well were it possible to get into closer touch with him, and that it is the Cambodian whom it is most difficult to touch, chiefly because of his purely buddhist education. The author then studies the development of the question under two main headings: — 1) agriculture properly speaking; 2) labour.

I. AGRICULTURE PROPERLY SPEAKING.

Present state of agriculture in Indo-China. — The principal crop of Cochin-China is rice of which numerous varieties are cultivated according to the soil, its composition, position, and the quantity and the nature of the waters it receives during the rainy season. The area under rice increases each year because there is still much available uncultivated land in certain parts of the colony. As a rule this land is unfit for cultivation and valueless as a result of the stagnation of the water which often causes an excess of alum. Where, however, the Administration builds a canal, this land gradually becomes of value, the excess of injurious alum being carried into the canals by the surface waters (rain, floods). In a general way it may be said that the clay soil of Cochin-China contains alum to a

more or less marked extent ; it occurs everywhere, in the low South-West regions and in the high forest districts of the eastern provinces.

With the exception of the eastern provinces, it may be said that all Cochin-China is one vast rice field, already planted or about to be so. Rain falls pretty regularly each year from May or June to October or November. It is usually early in the East and becomes later as the Gulf of Siam is approached, so that the harvest is earlier in the East and allows a large part of the population to go for the harvest to the western provinces, where labour is generally insufficient on the large estates.

In September or October, at the time of transplanting, the floods come in addition to the rain. The muddy waters of the Mekong spread more or less rapidly over that part of Cochin-China which borders on Cambodia. In the rest of the country, which is lower, the tides penetrate inland, bringing with them fertile mud.

The harvest is generally sure in Cochin-China ; it is sometimes more, sometimes less fine, even average, but there is no danger of famine. As rice forms the basis of the diet of the natives, Cochin-China largely supplies the food requirements of its population. In certain provinces (Chaudoc, Longxuyen) maize-growing has been started and tends to develop because the grain ripens and may be cut in three months, just as the first rains are beginning. It may, therefore, be grown in many rice fields near water-courses, so that it may be easily watered, and the same land may yield two crops of about equal value.

In 1915-16 Cochin-China produced 2 188 000 metric tons of paddy, in 1916-17, 2 350 000 tons. About 1 100 000 tons are kept back for local consumption and seed, the remainder is exported. Each year the harvest improves as a result of improved cultivation.

Agricultural products exported at the present time. — A table is given of the exports in 1914, 1915, 1916 and 1917. These products are :— rice (export about 922 259 metric tons in 1914 and 449 565 metric tons in 1917), paddy (approx. 41 482 metric tons in 1914 and 3 986 tons in 1917), cargo (approx. 25 181 metric tons in 1914 and 49 803 tons in 1917), rice bran (approx. 146 608 metric tons in 1914 and 72 605 in 1917), meals (approx. 159 944 metric tons in 1914 and 59 872 in 1917), maize (approx. 30 938 metric tons in 1914 and 7 485 in 1917), kidney beans (13 860 lb. in 1914 and 37 770 lb. in 1917), other dry leguminous seeds pepper, cattle (650 metric tons in 1914 and 100 in 1917), poultry, copra, peanuts, sesame and other oil-yielding seeds, fresh coconut, coconut oil, rubber (401 060 lb. in 1914 and 885 122 lb. in 1917), wood charcoal, kapok, various cakes, silks, silk wastes, ox hides, pig bristles, feathers, eggs (679 327 lb. in 1917), honey, feathers for fans, lard, castor oil.

Labour devoted to cultivation. — The different methods of farming, varying in each province, the different systems adopted by large land-owners to keep the workmen on their estates, to pay them, to advance them money and grain, are all reviewed. The expenses are fairly heavy as compared with the yield, but nevertheless the growing of rice by the present day methods yields a good profit. Many of the natives live well and give

an impression of ease and comfort very different from the poverty found among the natives of Tonkin and Annam.

Yields per acre. — RICE. — The yield varies from 80 to 100 *gia* for the average ricefields, or, 14.6 cwt. to 18.3 cwt (1 *gia* = 50.6 lb.) In certain soils it is as much as 120 or 150 *gia* (22 to 27.5 cwt.) and in poor soil, especially in the eastern provinces, may be as low as 20, 30, or 50 *gia* (3.7, 5.5 or 9.2 cwt.).

MAIZE. — Yields a profit in the province of Chaudoc about equal to that of rice.

TOBACCO. — This crop is being developed. It is grown mainly in certain parts of the east. The tobacco has a peculiar flavour and, for that reason, is only used by the natives and is consumed entirely in the country. The province of Giadinh yields the two best qualities of tobacco:— 1) Govap tobacco, the most appreciated by the natives, 2) Hocmon tobacco. One acre yields approximately 1943 cakes of govap tobacco weighing 300 gm. each, or 9.6 cwt.; the sale price is \$ 35 (1) per 100 cakes or \$ 680 with a profit per acre of \$ 85. One acre yields about 1217 cakes of Hocmon tobacco, weighing about 8.3 cwt. and selling at \$ 29 per 100 cakes, or \$ 400, the profit per acre being \$ 72.

SUGAR CANE. — Sugar cane is grown over about 11 000 acres in the eastern provinces. The species most widely grown for sugar production in this district are yellow cane, called "mia-vang", planted in low, rich soils, red cane, called "mia-ly", grown in rich, moist soils, and small cane, called "mia-lau", grown in high, dry soils; "mia-vang" yields 17.5 tons per acre and sells at \$ 265; "mia-ly" yields 11.5 tons per acre and sells at \$ 226; "mia-lau" yields 9.5 tons per acre and sells at \$ 111; the cultivation of this last variety is decreasing.

PEANUTS. — 30 to 32 *gia* per acre. Green peanuts weigh 26 to 33 lb. per *gia* and dried ones 22 to 24 lb. The sale price is approximately \$ 0.60 to \$ 0.65 = $0.65 \times 30 = \$ 19.50$ (for 30 *gia*) per acre.

SWEET POTATOES. — 20 *gia* of 48 to 50 lb. on an average; \$ 0.80 approximately, or \$ 16.

MANIOC. — Approximately 6.7 tons per acre. Sale price \$ 1.90 per picul of 132 lb. or \$ 217 per acre (a net profit of \$ 121).

Possible improvements. — The ploughs seem suitable to the nature of the land. Cochinchina rice is at least equal in food value to the best varieties of Japan, Java or Burma, but is less fine. It is, therefore, necessary:—

1) That the natives harvest so as to avoid any moistening of the sheaves because the rice often ripens before the soil of the field is quite dry. The sheaves are laid on the ground in small heaps so that the upper ones do not come in contact with the water, but the lower ones become wet and the grain spoils.

2) That the crop, which is usually threshed in the field, be brought in so as not to be wetted by late rains.

(1) 1 Indo-Chinese silver piastre (\$) = 25.3d. at par. (Ed.)

3) That the natives be provided with sorters so that they may set the finest grain apart *a*) for sowing, *b*) for selling, keeping the remainder for local consumption. In this way the natives would be able to select the grain easily and rapidly and supply better qualities with a higher yield.

According to the native nomenclature there are numerous varieties of paddy which, with the exception of the round grain and long grain varieties, are very difficult to differentiate. They are similar rices which have become slightly modified according to the nature of the soil in which they are grown. Sorting the grain would reduce these numerous varieties to a small number, taking into consideration the species with round or long grain, early rice and mid-season rice, and the nature of the fields, high or low, swampy or not. The swamp and semi-swamp rices of Chaudoec and Longxuyen form a very interesting distinct variety, the cultivation of which has been greatly improved by the natives who have produced swamp rices with practically none of the red grain which detracts so largely from their value. Good, inexpensive sorters should, therefore, be supplied. If selection of the good grain were combined with the rooting up of foreign varieties the quality of the grain would be rapidly improved.

4) The natives cut the rice sheaves by hand with a sickle at mid-height. A large quantity of stubble is thus left. Animals are first pastured in the field, but when they will not eat the straw because it is too dry advantage is taken of the strong winds of the dry season to burn it. The ashes obtained are of small advantage to the soil, especially as the wind carries many of them far. It would appear more advantageous not to burn the culms but to plough them in. They would decompose rapidly in the water-soaked soil and the roots of the new plants would derive benefit from them.

5) Fertilisers have been recommended to improve the yield, but the question is very complicated. The natives are poor and, generally, have few savings, living from hand to mouth, so that any fertiliser supplied must be cheap. The yield of the Cochin-China rice field is low when compared with those of Java. Cultivation is extensive because free land is not lacking and will not lack for a long time. More than double the quantity necessary for local consumption is produced. If it were possible to obtain a cheap fertiliser it is not certain that the benefit obtained would pay the expenses. In Cochin-China, where the Mekong River is not dammed, as is the Red River, in Tonkin, the whole country is flooded naturally in September and October. The waters, charged with fertilising mud, spread over the whole country, and the natives, by a very simple system of gutter-stones and gaps in the banks of the rice fields, make the waters penetrate far inland. The rice plants act like innumerable sieves and filter the muddy water, which, losing the rapidity of its current, deposits the mud on the soil. Fertilisers spread on these fields full of water would dissolve very rapidly and be largely carried away by the waters in the canals and ditches, or each field would have to be well shut in and would no longer benefit by the floods and the movement of the fertilising waters. Would there be any appreciable advantage to the

natives, for whom nature works, for the floods are rarely heavy enough or sufficiently prolonged to damage the crop. The natives profit more than they suffer.

6) It also appears premature to use machines for cultivation. The natives have adapted their tools to the soil and the nature of the plant they cultivate. European machines are too heavy to use in a soil which only dries and hardens when nature allows it to do so. The natives use a hoe, plough and wooden roller. The rice is generally threshed in the field in large wide-mouthed baskets about 6 $\frac{1}{2}$ feet high, made of bamboo laths plugged with earth. As the grain drops easily, the sheaf is beaten on a sloping bench placed inside the basket; the grain drops to the bottom and is collected in baskets. To carry the rice sheaves to the farm a sledge drawn by oxen or buffaloes is used. This sledge passes everywhere, making gaps in the embankments of the rice fields. This material is simple, easily made and repaired, and adequate.

The only improvement required at present is that the Annamites should select their seed so as to prevent degeneration of the plant and decrease in yield. For this purpose they should be supplied with good, cheap sorters.

Each year Cochin-China receives from Cambodia, Laos and South Annam live stock to replace that which has died or to meet the requirements of the increased population. The demand has become yet greater since the formation of large rubber plantations which often require large herds for ploughing or fertilising purposes.

Breeding. — Cochin-China is not a breeding country and probably never will be on account of the floods in the west and the short grass produced by the poor, dry soils of the East during the dry season.

Factors favourable to the development of native agriculture. — Agriculture has hardly made any progress in the colony, it has developed in acreage only, not in yield, but in this sense has developed considerably. This is due to the reclaiming of immense uncultivated plains by digging canals with dredgers. Colonisation by Europeans has also increased.

Agriculture will develop more and more if numerous roads and canals are built. The regulation of labour (decrees of March 8, 1910 and May 20, 1913), largely imported from Annam or Tonkin, less from Java, has facilitated the establishment of rubber plantations in the East. The decree of April 13, 1909 concerning native workers on farms has been of more use to the French colonists of the West. The granting of land under special conditions with certain advantages has favoured both native and European colonisation.

Native agriculture (special reference is made to rice, all the other crops being secondary as compared to it) is developing normally under the effects of several causes :—

- 1) Some administrative :— digging numerous canals with dredgers, good maintenance and improvement of the natural and artificial transport ways already existing, etc.; the greatest attention is being given to this
- 2) The other natural :— the increase of the population which now

numbers approximately 3 500 000 and increases by about 100 000 annually.

II. LABOUR.

As the rule the natives are both farmers and fishers; in the wooded districts they are also foresters. Only the Moïs a woodman in particular and cultivates barely enough for his requirements.

Up to the present the labour question for the crops of Europeans has not become acute. In the western rice fields the decree of April 13, 1909 concerning agricultural labourers makes it easy for the colonists to obtain labour. In the rubber plantations of the East the decrees of March 8, 1910 and May 20, 1913 regulate the connections of the planters with the numerous workmen they are bound to employ, mostly in distant and unhealthy districts. They not only deal with foreign labour, but also with Indo-Chinese labour. Some people have brought over Javanese, most bring men from Annam or Tonkin, the latter being acknowledged to be better than those from Annam. By employing also the natives and, in some districts the Moïs, the planters have been able to obtain the necessary labour.

The two decrees are to be fused into one decree more suited to the present requirements. This modification has been found necessary as a result of certain difficulties which arise from time to time in some plantations. It will provide for an inspection of labour which will probably be entrusted to the Inspector of Political and Administrative affairs. It also provides for fixed salaries, the form of work, assistance and care in the case of sickness, boarding, feeding, water-supply, etc. On the whole the planters (less in the West, because it is healthy) have done their best for the comfort of their workmen. Rewards are given to good and old labourers, houses of a more or less permanent character of clay or bricks roofed with tiles have been built for them and their families. Drinking water is supplied, there are ambulances and hospitals, markets have been formed so that they may supply themselves without difficulty, even amusements are supplied at certain times of the year on the occasion of their religious festivals, theatrical companies, and cinemas.

There as elsewhere if the natives are comfortable they ask nothing better than to remain and be re-engaged. The labour on a plantation represents a large capital and the better it is, in better condition is the plantation and, consequently, more productive. It is in the interest of conscientious planters to look after their workmen and treat them well. On the large western agricultural estates the labour changes but little as a rule; the conditions remaining the same the workman show no desire to go, and remain on the estate. Only those go who are badly treated or who, by nature, are fond of change and cannot settle in one place.

There is, however, no doubt that the labour in the country is inadequate to the development of the plantations in the East; imported labour will be needed more and more. If the development in the East continues as

at present great attention will have to be given to the importation of labour or it will become a real danger to the agricultural settlement of the West, where labour is already insufficient. The importation of labour must be facilitated but, in the author's opinion, only labour from Indo-China, Tonkin and Annam should be used. Any kind of work may be entrusted to the Annamite if he is correctly approached. He is a product of an old civilisation which has developed without interruption and there is no doubt that he is destined to colonise all Indo-China.

1191 — **Foods of Tonkin.** — CHEVAST, C., in *Congrès d'Agriculture coloniale, Gouvernement Général de l'Indochine*, Hanot Series, No. 2, 17 pp. Hanot-Haiphong, 1918.

In these notes which form a complement of the "*Catalogue des Produits de l'Indochine*, Vol 1, *Produit alimentaires*", the author (Inspector of the Agricultural Services, Keeper of the Agricultural and Commercial Museum) reports the foods peculiar to Tonkin which are suitable for consumption in France.

I. — **VEGETABLE FOODS** — *Rice.* — Tonkin can export an average of 200 000 metric tons of rice and paddy. Of this quantity the Tonkin rice-fields at Haiphong can supply 9 to 15 000 tons of polished (table) rice. The annual production could reach 30 to 35 000 metric tons.

Maize. — In 1913, Tonkin exported 53 000 metric tons, in 1915 only 23 454 tons, and in 1916 5500 tons. The decreased exportation is due to the rapidly increasing local consumption.

Kidney beans. — Their cultivation will be intensified in Tonkin.

"*Mungo peas*". — The small French bean has proved suitable as a food in Europe cooked as other beans and prepared as "purée" so as to remove its outer coat; it has a vegetable taste peculiar to itself. Tonkin could supply nearly 500 metric tons of these beans annually, the other countries of Indo-China about 700 tons together at an average price of 6 to 7 *piastres* per 100 kg. (220 lb.).

Various dolichos. — Little liked in Europe because of their unpleasant vegetable taste, but perhaps suitable for livestock. In Tonkin alone an annual production of 1000 metric tons at \$4.50 to \$5 per 100 kg. may be relied on.

Soya. — The annual yield in Tonkin is approximately 1 000 metric tons selling at \$8 to \$9 the 100 kg.

Cereals. — In the Yunnan district where the climate is temperate, the author has as yet been unable to determine the amounts available or their value.

Manioc (slices). — There are two species in Tonkin, sweet manioc and bitter manioc, both largely cultivated. In normal times the dried slices are sent to France. About 100 metric tons of slices are available annually at an average price of 4 *piastres* per 100 kg.

Manioc paste ("Ho-Tieu"). — A product made in Annam; 14 *piastres* per 100 kg.

Bean vermicelli ("Song-Thân"). — In Annam 176 000 lb. per year are made. This product is distributed by Chinese buyers at Singapore, Hong-

Kong, Bang-Kok. It is an excellent dietetic food which could be used especially in hospitals.

Flours. — Tonkin has no large flour factory. The by-products of decortication (factory flours) are only usable as mash for animals. In Cochinchina the average amount of the exportation of these flours from rice factories is 128 000 metric tons.

Arrowroot starch. — In Tonkin this is prepared from two plants — *Maranta arundinacea* ("Koang-Tinh") and *Costus speciosus*. Both these plants are being grown to an ever-increasing extent in the Delta and in certain provinces of Tonkin. The starch yield of the roots is 24 %. Arrowroot starch is very suitable as a food for infants and convalescents. The price is about \$ 0.30 per kg. of starch.

Sweet potato starch. — The "Khoai-Lang" sweet potato with its 5 or 6 local varieties is much grown in Tonkin. The starch yield of the tubers is 15 %, the selling price \$0.30 per kg. of starch.

Sweet potato slices. — A local industry. These slices appear to yield 34 to 40 % of their weight in alcohol.

Yam (*Dioscorea*) starch. — Five or six species of yam are grown in Tonkin. The starch is very nutritious. There are no fixed prices.

Taros (*Colocasia*). — There are several species in Tonkin. The average price of the roots is \$0.40 a load of about 55 lb.

Annam and Tonkin spathe. — The Annam species "Khoai-Nua" is represented by *Amorphophallus campanulatus*. Tonkin spathe ("Khoai-Na"), *Amorphophallus Rivieri*, is much used as a food for pigs.

Tacca. — The plant ("Nua") is not cultivated in Tonkin, but in Central Annam occurs frequently enough to be taken into consideration. It yields as much as 30 to 33 % of food starch.

Bulb dolichos. — The tubers cost from \$0.80 to \$1 a load.

Kondzou. — The tubers are made into starch.

Sago. — In the high districts of Tonkin the mountaineers obtain the pith of certain palms such as "Cây-Dao" (*Phoenix farinifera*) and "Cây đoc" (*Caryote*). The manufacture is limited to the very small demand. The product should be sought in south Indo-China where *Metroxylum*, which produce good sago, is fairly common.

Vegetables: Bamboo shoots ("Mang-Tre-Khê"), \$0.32, \$0.30 and \$0.25 a pound of 600 gm. according to the three qualities.

Dried mushrooms: "Mộc-nhi" and "Nấm-huông".

Coffee. — Small production.

Tea. — The European colonies of Tonkin and Annam can supply an average of 500 metric tons of prepared tea.

Sugar. — Tonkin is still dependent on Annam.

Dried spices. — \$0.50 to \$0.60 the kg.

Camellia oil. — Tonkin and North Annam can produce about 20 000 kg. annually. The seeds sell at \$5 to \$6 the 100 kg., the oil at \$24 the 100 kg.

Peanut oil. — Tonkin produces few peanuts; south Indo-China pro-

duces far more. The average exports from Indo-China from 1910 to 1916 inclusive were 368 000 kg. of seed and 104 000 kg. of oil.

Sesame oil. — Sesame is well cultivated in Tonkin but yields little oil there (about 3 000 kg. were exported to China in 1914). In the rest of Indo-China the production is much greater. In Tonkin the seeds sell at \$13 per 100 kg. and the oil at \$20 to \$22 to 100 kg.

Coco-oil. — Coconut is rarely cultivated in Tonkin.

II. — ANIMAL PRODUCTS. — *Cattle.* — Tonkin receives 20 000 head of cattle annually from North-Annam and from 4000 to 5000 head from the Chinese province of Quang-si. A fairly large cold store has recently been erected at Bèn-Thuy, near Vinh (Annam) for dealing with frozen meat supplied from the livestock of North Annam and the neighbouring provinces of Laos.

Pigs. — As a result of floods the stock of pigs in Tonkin has decreased markedly; this accounts for the appreciable rise from \$0.32 to \$0.45 of pork on the Hanoi market. Nevertheless the breeding of young pigs for market is actively carried on in the mountains and, if the floods do not interfere again, it will not be long before the country is stocked normally. It is estimated that there are over a million pigs in Tonkin which is better stocked in this respect than any other country of Indo-China. The annual consumption of the town of Hanoi may be placed at 32 000 head. Estimating the total consumption of Tonkin to be 400 000 head, it should be possible to export a considerable amount of pork to France.

Pig's fat; lard. — The maximum quantity Tonkin can produce is 15 400 lb. of lard per month.

III. — SEA PRODUCTS. — *Dried and salt fish.* — In 1914, 1 337 600 lb. of such fish was exported from Tonkin to China. In a good year the sea catch of Tonkin gives a figure to which must be added from 100 to 120 metric tons of various products (holothuria, sharks' fins, etc.).

Dried shrimps. — A very substantial food; 26 400 lb. are exported to China annually.

Fish and shrimp pastes. — These pastes could not replace the very expensive cod's roe, obtained from Norway, but could at least be mixed with it. As much as 308 000 lb. (the export to China in 1910) may be produced annually.

Prepared holothuria. — Indo-China produces fairly large quantities; each year Tonkin exports about 50 metric tons to China. They sell at \$15 to \$20 the picul of 60 kg. (132 lb.).

Nuoc-mam. — A fish food made in three qualities, selling at \$2.50 and \$1.50 per petroleum tin (about 39 lb.).

1192 — Contribution to the Study of the Culicidae of French Guiana. — LEGER, M. (Institute of Hygiene of Cayenne), in the *Bulletin de la Société de Pathologie Exotique*, Vol. XI, No. 5, pp. 397-400. Paris, 1918.

Diseases transmitted by Culicidae are of the greatest pathological importance in French Guiana and have often proved serious obstacles to colonisation; malaria, filariasis and yellow fever hindered the economic

development of the country in the 19th century. The species of Anophelidae and Culicidae and their distribution throughout the colony are given. Only two species of Anophelidae are known — *Anopheles (Cellia) argyrotarsis* Desv. and *A. (C.) albimanus* Wied. (*cubensis* Agr., *albipes* Theob.); the second species is the more common.

The Culicidae identified by the author at the Institute of Hygiene of Cayenne are: — *Culex fatigans*, *C. digitatus*, *C. mathisi*, *C. flavipes*, *Culiseta taeniorhynchus*, *Taeniorhynchus fasciolatus*, *Mansonia amazonensis*, *Melanoconion drotum*, *Stegomyia fasciata*, and *S. luciensis*, a variety of the preceding one.

1193 — The Tatu (*Tatusia novemcincta*), Host of *Schizotrypanum cruzi* the Agent of "Minas Meningitis", in Brazil. — Chacaras e Quintais, Vol. XVII, No. 6, p. 450. São Paulo, June, 1918.

In 1912, at Lassance, Minas, Dr. CARLOS CHAGAS, director of the "Instituto Oswaldo Cruz" at Mangueiras, Minas-Geraes, Brazil, discovered that this armadillo or tatu (*Tatusia novemcincta*) is the primary host of the protozoan known as CHAGAS' protozoan (*Schizotrypanum cruzi*) which, when inoculated into man by *Triatoma (Lam.) megistus*, a sucking insect of the *Reduviidae* family, causes the very serious disease known in Brazil as "Minas meningitis" and "barbeiro". The acute form of this disease causes nervous trouble or meningitis (this especially in children), and its chronic form causes changes in the thyroid gland and cretinism.

The protozoan causes no disease in the tatu. When the insect, also known as "barbeiro", sucks the blood of an infected tatu *Schizotrypanum cruzi* develops in its intestinal tube, and passes through to the salivary glands. When the insect bites man it inoculates him with the parasite.

"Minas meningitis" occurs only where tatus live. The carrier insect *Triatoma megistus*, has been found both in human dwellings (especially huts) and the holes of tatus. If the animals were destroyed the contagious illness would disappear. Furthermore, an enemy of poultry yards would also be suppressed.

1194 — I. Vitamines and Symbionts (1). — II. The Action of Symbionts on the Constituents of Fats. — BERRY, H. and PORTIER, P., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXVI, I, No. 23, pp. 963-966. Paris, June 10, 1918; II, No. 25, pp. 1055-1057. Paris, June 24, 1918.

1. — After referring to the indispensability of vitamines in feeding, the authors give the results of the researches they carried out to ascertain if there is any relation between vitamines and symbionts (bacteria isolated from the tissues of normal animals).

A first series of researches showed that symbionts introduced into the vertebrate organism were perfectly tolerated, and caused no disorder or suppuration, and seemed to disappear rapidly from the circulatory system, tissues or serous membranes.

As these microorganisms were shown to be harmless, their possible intervention in the phenomena of metabolism remained to be proved.

(1) See R., October 1917, No. 920. (Ed.)

Young, but nearly full-grown, white rats were used as experimental subjects, then adult rats and finally pigeons. The rations given the subjects were such as would cause disorders of sub-nutrition after a certain length of time (seeds decorticated or sterilised at high temperatures for the pigeons; bacon or bacon fat sterilised at high temperatures, coagulated white of egg, salts and water for the rats). Controls received a ration composed of the same foods, but such as would not cause metabolic disorders (seeds with the seed-coats, unsterilised bacon or fat).

RESULTS. — 1) The experiments all confirm the chief results obtained by EYKMAN, GRYNs, FUNK, etc.:— loss of appetite, emaciation, locomotor troubles, paralytic phenomena, etc. A prolongation of the experiment led to death preceded by a very intense adynamic state and trophic disturbances in the rats.

When the animal suffering from nutritive deficiency (cared) was given a normal diet it continued to lose weight for a few days, but, under the influence of the vitamins in the food, the morbid symptoms gradually gave way and it recovered.

2) A cared animal, already intensely affected with the pathological phenomena already described, is taken and injected under the skin or in the peritoneum with a culture of living symbionts. After 24 to 48 hours, an extremely striking change takes place. The locomotory troubles vanish very rapidly; the animal soon recovers its agility and has a remarkable appetite, especially for fats; the loss of weight ceases, being replaced by a clear gain of weight.

These phenomena are still more striking with pigeons, which pass in a few hours from a complete adynamic state to an almost normal appearance in both walking and flying.

Repeated injections (always of 1 cc.) of the living cultures produce the same good results each time.

Thus the introduction into the organism of symbionts of appropriate origin and in suitable form, eliminates the nutritive deficiencies due to a diet lacking vitamins. The initial hypothesis was thus clearly verified by repeated experiments extending over several months.

The only objection that can be raised appears to be that the microorganisms injected act, as far as they are living, by the vitamins they contain and that any harmless bacterium could produce the same good effects.

It certainly seems that certain microorganisms (yeasts) contain vitamins but it should be noted that intestinal bacteria apparently do not contain vitamins since in nutritive-deficiency experiments disorders appear in spite of the abundance and variety of the intestinal flora. It seems remarkable that symbionts, normal inhabitants of the organism, can play the part of vitamins.

II. — The authors wish to show that symbionts can reproduce certain normal phenomena of animal metabolism, especially as regards the constituents of the fats.

Glycerine, which appears to be a source of sugar for the organism, is changed into dioxycetone (triose [C₃] sugar which easily changes to

hexose). On the other hand it can be probably shown experimentally that salts of α -glycerophosphoric acid can be changed into salts of dioxo-acetone phosphoric acid in the same way.

Symbiotes can also carry out, *in vitro*, the β -oxidation that applies to fats of low molecular weight. On inoculating a sterile, neutral broth containing 1 % of β -oxybutyric acid, proteins and nitrates with these bacteria, the presence of acetone and acetic aldehyde may be detected after 3 weeks. Starting from butyric acid and using a similar medium to that described, the authors found acetone present in the culture solution; the other substances were not sought for. The presence of acetone shows the production, at a given moment, of the corresponding β -ketonic acid and that of acetic aldehyde shows that the fat molecule has been greatly broken down.

This is the first example, so it appears, of the carrying-out of the physiological process in question by means of microorganisms.

195 — **Studies on Nitrogen Poisoning.** — Maignon, F., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXVI, No. 22, pp. 919-922; No. 24, pp. 1008-1011; Vol. CLXVII, No. 2, pp. 91-94. Paris, June 3 and 17, July 8, 1918.

I. — INVESTIGATIONS INTO THE TOXICITY OF EGG ALBUMIN; INFLUENCE OF THE SEASONS ON THE SENSIBILITY TO NITROGEN POISONING. — MAGENDIE showed in 1816 that nitrogenous foods are indispensable to animal life; he also concluded they are insufficient in themselves as dogs fed on pure gelatine died from emaciation.

The author continued MAGENDIE's experiments and fed white rats on pure albuminoid matter (egg albumin, fibrin, casein) of the highest possible purity. Commercial finely powdered egg albumin was made up into pills weighing 1 gram by the use of a weak solution of gelatine. To avoid demineralisation of the experimental subjects small quantities of mineral salts and bicarbonate of soda were added to the pills so as to keep the urine slightly alkaline and to prevent acidosis. The experiments led to the following conclusions:—

1) Egg albumin is incapable of supporting life and maintaining weight in the white rat;

2) White rats fed on egg albumin die rapidly of acute poisoning of the central nervous system in May and October, but succumb slowly from emaciation in August and January.

These facts make it possible to understand the seasonal character of the manifestations of certain nutrition diseases connected with nitrogen poisoning; such as eczema, rheumatic troubles, etc.

3) Acute albumin poisoning causes coma.

II. — A COMPARATIVE STUDY OF THE TOXICITY AND THE NUTRITIVE POWER OF FOOD PROTEINS EMPLOYED IN THE PURE STATE. — The investigations, similar to the preceding ones and also made on white rats, dealt with fibrin, casein and meat powder, this last substance being previously extracted with boiling water, alcohol, and ether. In spite of this treatment the powder still contained an appreciable quantity of fat in the form

of adipo-protein compounds. These proteins were given at discretion in 1 gm. pills to which had been added, as in the previous case, mineral salts and bicarbonate of soda to avoid de-mineralisation and acidosis.

The experiments showed that none of the proteins tested are capable alone of supporting life and maintaining weight in the white rat, even for short periods. The influence of seasons, so marked for egg albumin, is entirely lacking for the other proteins. The toxicity can only be estimated by the length of time the animal survives. From this point of view the proteins under consideration can be classed in the following order for the white rat;—egg albumin, fibrin, casein, the latter being by far the least toxic. Meat powder may be placed on a level with fibrin.

With fibrin, casein and meat powder death, in every season, is the result of exhaustion of the reserves, not of chronic poisoning. The animals die from atrophy after heavy losses in weight. The lesions caused by food poisoning are insufficient to account for death. Rats fed with casein or fibrin have, after some time, a very fatty liver, which may be recognised by its yellowish colour and thick, rounded edges. The microscope shows the presence of excessive internal fat. In the case of casein the excess is double that caused by fibrin. It is not present with egg albumin and meat powder. The length of time the animal survives and the facility with which the albumins ingested change to fat are closely related. Everything points to the fact that the fat formed prolongs the period the animal survives by decreasing the rapidity with which the reserves are exhausted, the death occurring only when the reserves of fat have practically disappeared, as if this substance were indispensable to the utilisation of the proteins ingested. As the influence of the seasons does not exist with casein and fibrin, it seems as if the presence of fat makes the organism less sensitive to nitrogenous poisons in spring and autumn.

III. — INFLUENCE OF THE SPECIES OF ANIMAL ON THE TOXICITY AND UTILISATION OF FOOD PROTEINS. — After having studied the poisonousness and nutritive value of food proteins, using the cat and dog as subjects, the author compares the results obtained with the two species, using egg albumin, casein and meat powder.

1) With *egg albumin*, a fixed weight is never maintained in either cat or dog.

2) With *casein*, the two species behave quite differently; with the rat, a fixed weight is maintained with difficulty and death results from exhaustion rather than poisoning; with the dog, on the contrary, the weight is easily maintained, but it soon clearly feels the toxic action, being unable to transform casein into fat so easily as does the rat.

3) With *meat powder*, a fixed weight, impossible to maintain with the rat, is easily attained with the dog.

The author interprets these facts as follows:—The dog, naturally a carnivorous species, adapts itself better to a purely protein diet than the white rat, a carnivorous and often vegetarian species. On the other hand, the nutritive value of a food is not of necessity connected with its poisonousness (as in the case of casein and the dog); the toxicity of a protein

varies from one species to another and seems to be in relation to the capacity they have of changing protein into fat. When this transformation capacity is reduced in a species, that species is much more sensitive to the toxic action, which affords a new proof of the important part played by fats in the utilisation of proteins.

1196 - The Comparative Influence of Carbohydrates and Fats on the Utilisation of Food Proteins. — MAIGNON, P., in *Comptes Rendus de l'Académie des Sciences*, Vol. CLXVII, No. 4, pp. 172-173 + 2 Tables. Paris, 1918.

As egg albumin alone can neither maintain a nutritive equilibrium nor a fixed weight, the author, using white rats as subjects, investigated the influence of added starch or fat on the properties of the albumin in question. He varied the relative proportions of the constituents of the two foods, albumin-starch and albumin-fat, and each day estimated the food ingested and every two days weighed the subjects in a fasting state. The observations obtained led to the conclusion that the addition of fat or starch compensates for the deficiencies of the egg albumin, but with unequal efficacy; the albumen is better utilised with the fat than with the starch, the mixture of 1 of albumin + 1 of fat giving better results than 1 of albumin to 1 of starch. When the rats were fed with the three nutritive elements, albumin, fat and starch, the mixture containing as much fat as albumin again gave the best results. The minimum of albumin required is 3 times less with fat than with starch.

The author observes that, in meat, the fat is present in a slightly lower proportion than albumin.

It may, therefore, be concluded that fats play an important part in the utilisation of proteins, and cannot be replaced by carbohydrates.

1197 - On the Minimum of Sugar in the Diet and Hitherto Unconsidered Sources of Carbohydrates. — BERRY, H. and PORTIER, P., in *Comptes rendus de la Société de Biologie*, Vol. LXXXI, No. 11, pp. 574-576. Paris, 1918.

The importance of certain amino-acids in the diet (1) and the question of vitamins have complicated the general problem of nutritive exchanges. The derangement of metabolism caused by shortage of carbohydrates during total fasting or abstention from carbohydrates has given rise to doubts as to the possibility of complete iso-dynamic substitution of carbohydrates by fat. The author's recent investigations appear to throw new light on the subject.

Rats subjected to a diet of coagulated white of egg, bacon or pure bacon fat, water and salts, maintain a fixed weight and show no appreciable illness, but acidosis sets in as soon as the ratio of fat to albumin exceeds a certain proportion.

The author explains this fact as follows: — at first sight it appears opposed to the classical results of abstention from carbohydrates, but a careful study shows that coagulated white of egg contains carbohydrates or substances which form these compounds (free sugar, glucosamine, etc. in

(1) On this subject see *R.* April and June, 1918, Nos. 442 and 658. (Ed.)

quantities of 8 to 10 gm. of these substances per 1 000 gm. of fresh white of egg). On the other hand, the fat itself is a source of sugar; the glycerine may be changed into di-oxyacetone or triose sugar, and this last into a hexose by polymerisation (BERTRAND).

A diet composed of proteins and fat does, therefore, contain a certain quantity of carbohydrates of different origin so that there exists a *sugar minimum* just as there exists a nitrogen minimum. This minimum varies with the nature of the proteins, fat and sugars of the diet. A certain equilibrium between these factors is necessary to avoid metabolic disturbances.

1198 - The Food Value of the Banana. — PRESCOT, S. C. (Professor of Industrial Microbiology, Massachusetts Institute of Technology), in *The Scientific Monthly*, Vol. VI, No. 1, January, 1918, reprinted in *The Journal of the Board of Agriculture of British Guiana*, Vol. XI, No. 2, pp. 52-65 + 3 Tables. Demerara, April, 1918.

The banana is the principle source of carbohydrates in the diet of many tropical races, taking the place of the cereals and tubers of the diets of temperate zones. Numerous detailed investigations have shown the banana to give a larger unit yield in food material than wheat or any other crop. For this reason it must not be considered as a luxury but as one of the most important human foods, and should receive more consideration from physiologists and agriculturists than has hitherto been the case.

Many analyses have been made of the chemical composition of the edible portion of the fruit. The author gives the averages obtained by ATWATER and BRYANT (U. S. Department of Agriculture, Bull. No. 28, p. 71, 1906) which form a sort of general average of the composition of the different varieties (the banana usually eaten in the United States is the fruit of *Musa sapientum*):— Water, 75.3 %; protein, 1.3 %; fat, 0.6 %; carbohydrates 22 %; ash, 0.8 %; calories per lb., 460.

An analysis of the ash made by the author gave the following results:— Silica, 2.19 %; ferrous oxide, 0.18; lime, 1.82; magnesia, 6.45, sodium, 15.11; potash, 3.55; chlorine, 7.23; sulphur trioxide, 3.26; phosphoric acid, 7.68. The ash is, therefore, composed chiefly of phosphates, sulphates and chlorides of potassium, sodium, magnesia, and lime, i.e. salts which respond the best to the demands of the body. The banana contains all the substances necessary to maintenance, but its low protein and fat content as compared with the carbohydrate content do not make it possible for the banana *alone* to form a well-balanced ration. To remedy this defect it is sufficient to add milk or a small amount of meat to the ration.

The banana compares favourably with the best animal or vegetable foods; this is shown by a comparative table including widely-different foods. The analytical data given by ATWATER and BRYANT (*ibid.*, p. 68) for the potato are:— water, 78.3 %; protein 2.2 %; fat, 0.1 %; carbohydrates, 18 %; ash, 1 %; calories per lb., 385. These may be compared with the values given above for the banana, from which it is seen that the banana exceeds the potato by about 20 % in food value and calories.

It is commonly believed that the banana is indigestible if not cooked; this is only true if the fruit is insufficiently ripe and completely fallacious

or the completely ripe banana, as has been shown by many workers. The following figures which give the duration of *complete digestion* of various foods show that a ripe banana is digested more rapidly than the most common foods:—

Ripe bananas, 1 hour 45 minutes; vegetable marrow, 1 hr. 45 min.; melons 2 hr. 5 min.; beans, apples, 2 hr. 30 min.; green peas, 2 hr. 35 min.; oranges, 2 hr. 45 min.; oatmeal, 3 hr. 5 min.; roast mutton, 3 hr. 15 min.; boiled eggs, boiled potato, codfish, 3 hr. 30 min.; plums, 3 hr. 40 min.; mts, 4 hr.; boiled beef, 4 hr. 15 min.; cabbage, 4 h. 30 min.; roast pork, 4 hr. 20 min.

The rapid digestion of the banana is caused by the fact that during mastication the carbohydrates are largely transformed to assimilable sugar in the mouth, and further transformation in the stomach requires comparatively little time. The banana is, therefore, not only richer in nutrients per unit of weight than many common foods, but is also more digestible.

For these reasons this fruit should be more largely consumed, especially under present conditions, when it might help to overcome the shortage of cereals and other carbohydrate foods. This is all the more easy as its production is abundant throughout the year, that it may be shipped long distances, may be eaten raw or cooked, as a fruit or a vegetable, and is one of the few foods the price of which has remained normal during the last years.

99 - Foundation of a High School of Agriculture and Forestry in Indo-China; Prospects of Subjects Taught. — *Journal Officiel de l'Indochine Française*, Year XXX, No. 29 bis, pp. 689-694. Saigon, April 10, 1918.

The Governor General of Indo-China has issued a decree for the establishment in the colony of a High School of Agriculture and Forestry in order to train farmers and foresters capable of rationally managing the agricultural and forest lands of the country. A diploma will be awarded and will entitle the holders to enter the agricultural and forestry services of the colony. The different articles of the decree deal with the organisation of the school.

Entrance is by competition. The students must be not less than 16 years old and not more than 22 and must be able to show they are French subjects, under French protection, or Asiatic French citizens. They must also have one of the following qualifications: — "diplôme d'études complémentaires", "brevet élémentaire" or "brevet supérieur de l'enseignement primaire", "baccalauréat de l'enseignement secondaire". The students receive a monthly maintenance grant.

The period of study extends over three years. The curriculum includes: 1) general instruction (1st year); 2) technical and professional instruction (2nd year); 3) special subjects (3rd year). The 1st year courses are attended by both agricultural and forestry students; they deal with physics, chemistry, botany, zoology, geology, agriculture, applied natural history, mathematics, mechanics, topography, book-keeping, horticulture and gardening.

The 2nd. year courses are divided into two distinct parts : — 1) theoretical part together with six months' practical work (economic botany, agricultural zoology, animal breeding, agricultural meteorology, agrology, rural economics, ethnography, and hygiene); 2) an essentially practical part lasting three months (cultivation of industrial plants, agrology, rural engineering, book-keeping and sericulture).

The 3rd. year is devoted to the study of special subjects. The students attend the courses and practical classes in a special school in Cochin-China. This school includes : 1) a museum ; 2) a demonstration farm with a model dairy ; 3) a model silkworm nursery ; 4) a bee hive ; 5) experimental and demonstration plots (rice, maize, coffee, tea, sugar cane, cotton, rubber, coconut); 6) laboratories (botany, chemistry, entomology, wood-testing); 7) a meteorological station; 8) a tree nursery. At the end of the 3rd. year of study the students are examined in agricultural and forestry subjects. Each qualified student then works for a year either at an Agricultural Station (for agriculture) or at the Fuyen-Quang nursery, a sub-temperate forest (for forestry).

A detailed prospectus is appended to the decree.

CROPS AND CULTIVATION.

1200 — **Partial Correlation Applied to Dakota Data on Weather and Wheat Yield.** — BLAIR, T. A., in *Monthly Weather Review*, Vol. XLVI, No. 2, pp. 71-73. Washington, February, 1918.

In previous papers the author showed for Dakota : —

1) The existence of a *positive* correlation between the total rainfall for May and June and the yield of spring wheat, the relative correlation coefficient r (1) being equal to $+0.63 \pm 0.05$ in North Dakota and $+0.59 \pm 0.06$ in South Dakota ;

2) the existence of a higher *negative* correlation between the total temperature for June and the yield of spring wheat; $r = -0.67 \pm 0.08$ for North Dakota and -0.73 ± 0.07 for South Dakota.

In addition to these two correlations the author calculated that between rainfall and temperature and always obtained negative values for r . In other words, to a wet May and June corresponds usually a cool June.

These preliminary data give rise to two interesting questions :

a) How much of the apparent relation between rainfall and yield is really due to the influence of rain and how much to the simultaneous action of temperature ?

b) How much of the apparent relation between temperature and yield is really due to the temperature and how much is due to the simultaneous action of rainfall ?

The two questions may be solved by the use of *partial correlation* coefficients.

(1) See R., February, 1918, No. 148, note at foot of p. 175. (Ed.).

ficients by calculating the correlation between two variable factors after the elimination of one or more other factors. In the present case, where there are three variables — rain, temperature, and yield — the partial correlation coefficient is represented by the formula :—

$$r_{\alpha\beta\cdot\gamma} = \frac{r_{\alpha\beta} - r_{\alpha\gamma}r_{\beta\gamma}}{\sqrt{(1 - r_{\alpha\gamma}^2)(1 - r_{\beta\gamma}^2)}}$$

Here the variables are represented by α, β, γ . The terms $r_{\alpha\beta}, r_{\alpha\gamma}$ and $r_{\beta\gamma}$ represent the *total* correlation between each pair of variables (e. g., between rain and yield, temperature and yield, etc.), and $r_{\alpha\beta\cdot\gamma}$ represents the *partial* correlation between the factors α and β after the factor γ has been eliminated.

If, using this formula, the factors rain, temperature and yield are represented by the letters p, t , and y , the equations are :—

$$r_{py\cdot t} = \frac{r_{py} - r_{pt}r_{ty}}{\sqrt{(1 - r_{pt}^2)(1 - r_{ty}^2)}} \quad r_{ty\cdot p} = \frac{r_{ty} - r_{pt}r_{py}}{\sqrt{(1 - r_{pt}^2)(1 - r_{py}^2)}} \\ r_{pt\cdot y} = \frac{r_{pt} - r_{py}r_{ty}}{\sqrt{(1 - r_{py}^2)(1 - r_{ty}^2)}}$$

If the letters are replaced by their values, calculated by correlation tables, and the three equations resolved, the values given in the following table are obtained :—

	r_{py}	r_{ty}	r_{pt}	$r_{py\cdot t}$	$r_{ty\cdot p}$	$r_{pt\cdot y}$
North Dakota . . .	+ 0.61	— 0.45	— 0.38	+ 0.53	— 0.30	— 0.14
South Dakota . . .	+ 0.49	— 0.62	— 0.56	+ 0.22	— 0.48	— 0.37

It will be seen that the total correlation coefficient r_{py} between *rainfall* and *yield* which in North Dakota is equal to + 0.61 and in South Dakota to + 0.49, is reduced to + 0.53 and + 0.22 respectively when the factor *temperature* is eliminated. A considerable part of the apparent effect of rainfall on the grain yield of spring wheat is, therefore, due to the simultaneous action of temperature. Similarly the coefficients for the effect of *temperature* only are — 0.30 and — 0.48 instead of — 0.45 and — 0.62.

The relation between the three factors under consideration is clearly seen. Moreover, the coefficients $r_{py\cdot t} = + 0.53$ and $r_{ty\cdot p} = - 0.30$ for North Dakota show the influence of rainfall to exceed that of temperature. This is the opposite to South Dakota where the coefficients + 0.22 and — 0.48 show the influence of temperature to be predominant. It is well known that the rainfall in May and June and the temperature of June are

not the only factors influencing yield. It is for this reason that the partial correlation coefficients considered, although high, are nevertheless far removed from unity (+ 1 or - 1).

1200 - A Method Recommended in the Argentine for Avoiding Frost Damage to Cane Stools. — ROSENFELD, A. H., in *Sugar*, Vol. XX, No. 5, pp. 182-183. Chicago, 1918.

In the province of Tucumán (Argentine) the early frosts which are frequent at the end of autumn or the beginning of winter (June 21) make it necessary nearly every year for planters to cut frost-bitten cane prematurely. Such cane contains more impurities and less saccharose than that cut at the end of July or the beginning of August. The bad effect of premature cutting is yet more marked on the crop of the following year. The stools cut in the middle or at the end of June begin to sprout very early in spring and the young shoots are attacked by frost and either killed or weakened in growth.

To estimate the damage thus caused the author carried out an experiment in a sugar plantation (striped cane). The methods of planting, cultivation, etc., were kept as uniform as possible and two harvests made, one on June 22, the other on August 2, 1912. The following year the cane was cut on July 24. Comparative figures of the yield and composition of the cane are given in the following table:—

Date of harvest	Cane harvested on July 24, 1913								
	Yield in kg.		Stalks		Analysis of juice				Kg. of sugar per hectare
	per row of 100 m	per hectare	Number per row of 100 m	Average weight in kg.	Brix	Saccharose	Glucose	purity	
in 1912									
June 22	350	23 100	519	0.76	17.6	15.8 %	0.1 "	89.6	2 290
August 2	481	31 746	626	0.77	18.8	17.0 %	0.1 %	90.5	3 420

These results are absolutely convincing: plants cut in August, 1912 gave, in 1913, a yield per hectare exceeding that obtained with cane cut prematurely (June 22) by 8 500 kg. The injurious effect of frost is also clearly seen from the number of stalks per row of 100 m., plants cut in August 1912, yielding 107 more, in 1913, than those cut in June and, in spite of the close growth, these stalks weighed, on an average, slightly more than those cut in June. The August stalks also contained 1.2 % more saccharose and 1130 kg. more sugar per hectare.

It is quite clear that great advantage is to be derived from cutting the cane as late as possible, but, as has already been said, nearly every year the early frosts oblige the planters to harvest early. To remedy the disadvantages arising herefrom it is advised to cover stubble with soil by passing the plough between the lines. To test the benefit obtained from this method the author made an experiment in a plantation of purple sugar-cane with

alternate plots of 4 covered and 4 uncovered rows. Below are given the results obtained the following year.

	Cane harvested in 1913							
	Yield in kg.		Stalks		Analysis of juice			kg. of sugar per hectare
	per row of 100 m	per hectare	Number per row of 100 m	Average weight in kg.	Brix	Sac- charose	Glucose purity	
Uncovered stubble	545	35 970	700	0.79	18.8	17.0 %	0.1 %	90.5
Covered stubble.	509	39 534	719	0.83	19.3	17.8 %	0.1 %	91.9
								4 525

This method is, therefore, satisfactory. The earth-covered plots yielded 3 500 kg. of cane per hectare and 650 kg. of sugar per hectare more than the uncovered plots. The method is recommended wherever practicable as it is both easy and inexpensive.

1202 - Relation of the Density of Cell Sap to Winter Hardiness in Small Grains. —
See No. 1217 of this Review.

1203 - Investigations into Flocculating Power in Soil. — I. MASONI G., Coagulating Action of some Soluble Salts on Clay in Soil, in *R. Università di Pisa, Istituto di Chimica agraria, Studi e Ricerche*, Pt. 22 (1909-1914), pp. 247-293 + Bibliography of 30 Publications, Modena, 1917. II. LEONCINI, G. and MASONI, G., Determination of the Flocculating Power of Soil Solution, *Ibid.*, pp. 406-420.

I. An experimental study of the following three phenomena, which may be closely related: — A) flocculating power of soluble salts on clay in soil; B) influence of this flocculation on the permeability of the soil; C) absorption of part of the flocculating electrolytes as a result of flocculation. The study was limited to the action of certain neutral salts which are of the greatest interest from an agricultural point of view, either as essential constituents of fertilisers or because of their solution in waters which come into contact with the soil, such as chlorides, nitrates, sulphates of sodium, potassium, ammonium and calcium. Ordinary soil not too rich in clay and poor in organic matter was used. It was first dried in the air, then sifted to remove the fine particles.

CONCLUSIONS. — A) Chlorides have a greater flocculating power than equal weights of nitrates which, in their turn, are superior to sulphates. Calcium salts have more flocculating power than those of potassium and ammonium, and these more than sodium salts.

There is no ratio between the weight of salts used and their flocculating action. There is, however, a close relation between the solution of a given salt, the ion concentration and the degree of dissociation of the solution. The flocculating power of each salt decreases with the increase in the ion concentration, dissociation decreasing at the same time; there is no simple ratio between these phenomena. The flocculating action of the salts tested is due exclusively to the cations and the clayey matter acts as a negative

colloid. It is clear that, as the anions take no part in the flocculation *the various cations act diversely*.

Concentration and dissociation being equal, salts with *identical cations* and *different anions* have the same flocculating power. If only the dissociation is equal the flocculating power varies with the concentration and, if only the concentration is equal it varies with the dissociation. If both the concentration and dissociation vary, the flocculating power increases when both of these increase; it also increases when the concentration increases at the same time the dissociation decreases. There is, however, no simple ratio between the first and second ratios.

The flocculating power of salts with *identical anions* and *different cations* depends neither on dissociation nor concentration. The difference in the flocculating power of the chloride, nitrate and sulphate of the same metal does not depend on the anion, but solely on the cation, dissociation, and concentration. The *valency of the cation* has a relative influence on the flocculating power, but not the *atomic weight* of the different elements. The *relative unitary* flocculating power of each cation decreases as the concentration increases (but not in a simple ratio).

Taking the flocculating power of sodium (Na) as equal to 1, the relative unitary flocculating power of the other elements may be fixed approximately as follows:— Potassium (K), 2.4; Ammonium (NH_4), 2.4; Calcium (Ca), 5.7.

B) The modifications in the permeability of the soil caused by saline solutions have no direct relation to the flocculating power of these solutions on clay, even in the case of very thick layers of soil and relatively concentrated solutions.

C) During the flocculation of the clay particles fixation of the active elements occurs, but it is not yet known if this fixation is due to the flocculation itself, i. e., to simple *adsorption*, or to an *exchange* of the elements mentioned with other elements of matters acted on by the salts.

II. — When studying the properties of soils it would be advantageous, in addition to the chemical analyses and physico-chemical investigations into the *aqueous solution*, to determine easily and rapidly the *flocculating power of this solution*. Taking as a basis the flocculation of kaolin by this solution the authors evolved the following rapid method:—

In an APPIAN levigator are placed 0.5 gm. of very fine kaolin, 200 cc. of the solution to be tested added and the whole shaken for 30 minutes and left to stand for 6 hours. The thick liquid is then poured into a flask and the amount of kaolin in suspension determined by the difference between the residue left by 100 cc. of the thick liquid evaporated to dryness at 105°C . in a platinum dish and the residue left, under the same conditions, by 100 cc. of the solution examined. The smaller the amount of kaolin in suspension, the greater should be the flocculating power of the solution examined, so that, all else being equal, it may be considered as inversely proportionate to the amount of kaolin in suspension and, in comparison with distilled water, be expressed by the formula $Pf = \frac{4}{S}$, where Pf represents the flocculating

power to be determined, A the weight of kaolin left in suspension in the distilled water, and S the weight of kaolin left in suspension in the solution examined.

1204 - **The Action of Neutral Salts on Humus and other Experiments on Soil Acidity.**

— GILLESPIE, L. J. and WISE, L. E. (Laboratories of the Office of Soil Fertility, Bureau of Plant Industry, U. S. Department of Agriculture), in the *Journal of the American Chemical Society*, Vol. XL, No. 5, pp. 796-813 + 1 Fig. Easton, Pa., May, 1918.

The investigations described deal with the action of neutral salts on humus and the behaviour of litmus paper towards different acid solutions, and were made to determine the nature of soil acidity. The addition of chlorides of sodium, potassium or barium in solution greatly increases the hydrogen-ion concentration determined electrically. As, however, this increase in acidity is also observed, though to a lesser extent, when potassium chloride acts on true solutions, saline or acid, containing no humus or other undissolved substances, great care must be taken in drawing conclusions as to the process of the phenomenon where humus is concerned. With equal concentrations barium chloride has the greatest effect on the electrometric potential of humus preparations although it has not been definitely proved that barium acts more strongly than potassium on humus.

Great care must also be taken when determining the acidity of soils with litmus paper because, even in greatly diluted solutions of hydrochloric acid, the result is largely influenced by the neutralising action of the solution analysed.

It is improbable that soils can act on litmus paper by their adsorptive power alone. The difference observed between moist soil and its aqueous extract is probably attributable to the slight solubility of the organic substances of the soil.

It is not possible at the present time to give any general explanation of soil acidity, but the determination of truly acid soils by the hydrogen electrode and suitable indicators may be considered reliable although the data on the adsorption or action of neutral salts on soils is still negative. The litmus paper test applied to moist soils may give results of a certain practical value if the necessary precautions are observed. The subsequent choice of simpler methods is connected with a deeper knowledge of the relation between the hydrogen-ion concentration, on which the true acidity of soil depends, and their various biological activities (1).

1205 - **Isolation of Cyanuric Acid from Soil, in the United States.**— L. WISE, L. E. and

WALTERS, E. H. (Bureau of Plant Industry, U. S. Department of Agriculture), in the *Journal of Agricultural Research*, Vol. X, No. 2, pp. 85-91 + 1 Fig. + Bibliography of 13 Publications. Washington, July 9, 1917.

While examining a sample of Indiana silt loam the authors isolated a nitrogenous organic compound, cyanuric acid ($C_3H_3N_3O_3$). It was identified by comparing in detail its properties with those of synthetic cyanuric acid, prepared by heating urea in the presence of zinc chloride (VON WALTHER'S method).

(1) See R., Nov. 1917, No. 996. (Ed.).

The largest amount of this acid found was 0.150 gm. from 23 kg. of soil, but the amount was reduced by losses during evaporation. Subsequently cyanuric acid was found in various soils from different districts: — a Maine loam soil in which potatoes were grown (0.165 gm. of acid from 46 kg. of soil), in a Florida sand soil in which oranges were grown (0.04 gm. from 23 kg.), in a Texas soil (0.04 for 46 kg.) identical with that from which the authors isolated α -crotonic acid (1). Cyanuric acid has apparently never previously been isolated from a natural source. It is suggested that it may be formed in soil, by the decomposition of nucleoprotein or purin bases.

1206 — New Observations on the Biological Absorption of Methane and the Distribution of Kaserer and Söhrngen Methane Organisms in Soils, Mud and Farm Manures. —

GIGLIOLI, I. and MASON, G., in *R. Università di Pisa, Istituto di Chimica agraria, Studi e Ricerche*, Pt. 22 (1909-1914), pp. 76-108, Modena, 1917.

In nature methane is produced in large quantities by the decomposition of vegetable detritus and, as it is only slightly soluble, should pass almost entirely into the atmosphere, where, as a matter of fact, only slight traces of it occur. This leads to the supposition that in soil and water it undergoes actions which change it rapidly. The investigations of M. W. BEIJERINCK and A. VAN DELDEN (1903) gave the first experimental proof of the existence of soil micro-organisms (especially *Bacillus oligocarbophilus*) capable of feeding on gaseous hydrocarbons. Later the work of H. KASERER and N. L. SÖHRNGEN showed more definitely that methane really is absorbed by soil micro-organisms. From his first cultures SÖHRNGEN was able to isolate a special bacillus which he called *Bacillus methanicus*.

The great interest of SÖHRNGEN's experiments led the authors (1906-07) to verify them and to specify some of the conditions under which absorption of methane occurs and to collect observations on the distribution of *Bacillus methanicus* in the soils of Pisa, Italy, and its surroundings. They began their study with a few preliminary tests, followed by two sets of experiments at different seasons. In the first set (March 1-April 4, 1906) they studied the phenomenon in the presence of sewer contents and the mud of the Arno. In the second (April 30-July 30, 1907) the study was extended to field soil taken at various depths, fresh manure, rotted manure, and liquid manure, working in the light, in the dark, at a constant temperature of 30°C or average room temperature, as well as in the presence of an antiseptic (chloroform). Experiments were also undertaken to verify whether gaseous hydrocarbons other than methane could be absorbed. For all the experiments SÖHRNGEN's purely mineral culture fluid was used; it contains for 100 parts of distilled water, 0.01 of calcium sulphate, 0.1 of ammonium chloride, 0.05 of magnesia-ammonium phosphate, 0.05 of bi-potassium phosphate.

RESULTS. — In the first place they confirm those of the early experiments of KASERER and SÖHRNGEN, that is to say, that methane, in the presence of oxygen, is absorbed by soil bacteria. Its absorption and oxy-

(1) See *R. Jan.*, 1917, No. 6. (Ed.).

dation are biological phenomena which exclude the action of a soluble ferment or soil enzyme.

Light does not appear to have any special action on this biological absorption of methane which, however, is favoured by temperatures above that of the air and the surface of the soil, especially by temperatures round 30°C. Different varieties and species of methane bacteria seem to exist and act at different temperature.

In ploughed field and meadow soil, organisms which oxidise and absorb methane are rare and not very active on the surface, whereas they are abundant and active in the lower layers. They may also be in large numbers in river mud (of the Arno, for example). Manure (especially rotted and moistened), liquid manure, and sewer contents also contain many methane bacteria. Thus manure well dug in should help to enrich the soil in micro-organisms which prevent the loss of methane by forming, at its expense, new organic matter.

CONCLUSIONS. — Methane soil bacteria by preventing the total loss of methane of which they transform, in part at least, into new fixed organic matter either within their organisms or in their products, help to supply the soil with organic matter closely mixed with the constituents most favourable to fertility.

In appendix is given a chronological list of 82 works consulted on the origin and circulation of methane in nature and the connection of this gas with vegetable life. Some of these publications are briefly summarised.

1207 — **Experiments on the Influence on the Fertilising Power of Sewage of the Bacteria it Brings to the Soil.** — MASONI, G., in *R. Università di Pisa, Istituto di Chimica Agraria, Studi e Ricerche*, Pt. 22 (1909-1914), pp. 295-327 + Bibliography of 22 Publications, Modena, 1917.

The aim of the experiments described was to determine whether more or less sterilised sewage exercises on the soil an influence different from that of natural sewage. In one series of experiments the sewage was spread over the earth, in another it was mixed with the earth which was placed in earthen pots containing 26 lb. In the experiments were used:—

- 1) Pots without sewage.
- 2) Pots with sewage in the natural state.
- 3) Pots with sewage sterilised by boiling.
- 4) Pots with sewage partially sterilised with sulphuric acid at the rate of 1 % of their weight.
- 5) Pots with sewage treated with an amount of sodium sulphate corresponding to 1 % of sulphuric acid.

The better to determine the action of the micro-organisms of the sewage, earth completely sterilised by heating to 130-140°C. for 8 hours was used in the following group of pots:—

- 6) Pots with sterilised soil unmixed with sewage.
- 7) Pots with sterilised soil mixed with natural sewage.
- 8) Pots with sterilised soil mixed with sewage sterilised by boiling.

In this group the sterilised soil of the pots was moistened before beginn-

ing the experiment so as to give it the same moisture content as the natural soil.

RESULTS. — The second set of experiments especially (sewage mixed with soil) showed the following facts with respect to the yields and condition of the plants, not including the fertilising power of the sewage itself:—

A) Experiments with soil in the natural state. — 1) Sterilised sewage gave much better results than natural sewage.

2) Sewage treated with 1 % of sulphuric acid gave almost the same results as sewage sterilised by boiling.

3) Sewage treated with sodium sulphate gave better results than those with natural sewage but, on the whole, slightly inferior to boiled sewage and that treated with sulphuric acid.

B) Experiments with sterilised soil. — Pots with natural sewage gave higher yields, not only than the control pots, but than the pots with sterilised sewage.

Comparison between experiments A and B. — 1) Of the control pots those with sterilised soil always gave higher yields than those with natural soil, especially for maize.

2) With natural sewage buckwheat gave almost the same yields in both natural and sterilised soils, while maize yielded more in sterilised soil.

3) When boiled sewage was used sterilised soil was always inferior to natural soil.

CONCLUSIONS. — Partial or complete sterilisation tends to increase the fertilising action of sewage.

The two facts:— *a)* that sterilised sewage gave better results in natural than in sterilised soil; *b)* that natural sewage gave better results than sterilised sewage in sterilised soil, lead to the conclusion that, although sterilised soil of itself tends to give yields equal or superior to those obtained in natural soil, an organic fertiliser free from micro-organisms has always more effect in surroundings containing micro-organisms capable of acting on it.

Other experiments, in which the earth of the pots was aerated, confirmed on the whole the above results. This calls for a continuation of the study of the influence the bacteria brought into the soil by organic fertilisers may exercise, particularly on the phenomena of nitrification and denitrification.

1208* — Experiments on the Action of Manganese Dioxide on Nitrogenous Organic Substances, Especially Amides, With a View to the Use of this Dioxide as a Fertiliser. — LEONCINI, G. and PIERI, C., in *R. Università di Pisa, Istituto di Chimica agraria, Studi e Ricerche*, Pt. 22 (1909-1914), pp. 328-248. Modena, 1917.

A description is given of experiments *in vitro* made to determine whether oxidation of the nitrogenous organic substances is among the many actions of which manganese dioxide is capable in soil with respect to vegetation.

RESULTS. — Ammoniacal compounds are in no way oxidised by manganese dioxide. On the other hand, the amides of the fatty acids and urea in

aqueous solution are easily oxidised at boiling point with the formation of nitric acid and with the same intensity in an alkaline, acid or neutral solution but, at 30°C, oxidation hardly takes place (only slight traces of ammonia are sometimes formed), except in the case of the dicyanodiamide which at this temperature also gives slight traces of nitric acid.

Amino-acids in aqueous solution are not acted on at all by manganese dioxide. They give no nitric acid at 30°C or at boiling point whether their solution be neutral, alkaline, or acid.

The amides of the amino-acids act similarly. In only one substitution derivative of an amino-acid (hippuric acid) is a tendency of part of the acid to form ammonia noticed.

Finally, uric acid and its xanthine and hypoxanthine derivatives are slightly acted on by manganese dioxide; this is seen at times only from the formation of small quantities of ammonia.

CONCLUSIONS. — In most of the above-mentioned compounds the nitrogen link with the rest of the molecule is so strong that it makes the molecule refractory to the oxidising action of manganese dioxide at either the relatively low temperature of 30°C, or even at boiling point, at least from a point of view of the transformation of nitrogen into nitric acid.

In the amides of the fatty acids and some of their polymers such as dicyanodiamide, the link between the amide group and the acid radical is weak, and, in several cases it suffices to boil them with an alkali or an acid to produce, by hydrolysis, the breaking up of the amide into ammonia and fatty acid. This would explain why manganese dioxide acts on such amides as a vigorous oxidiser, capable of transforming amide nitrogen into nitric nitrogen at boiling point, but to ammonia only at 30°C.

It is, then, almost certain that, apart from the small quantities of ammonia slowly transformed by the manganese dioxide, even at a temperature of 30°, if this dioxide were placed in the soil, where the temperature practically never exceeds 30°, it would have no direct oxidising effect of any practical importance on the nitrogenous organic matter. The dioxide may, however, have a very useful action by forming as a result of special environmental conditions, colloid solutions with an indirect diastatic action, by seconding the activity of bacteria, the specific agents of the various oxidations produced in soil, and, more specially, that of nitrifying bacteria.

1209 — Analysis of Phosphatic Fertilisers. — I. MASONI, G., Contribution to the Study of the Adulteration of Bone Superphosphates, in *R. Università di Pisa, Istituto di Chimica Agraria, Studi e Ricerche*, Pt. 22 (1909-1914), pp. 139-170. Modena, 1917. — II. QUARTAROLI, A. and ROGAI, A., On the Use of Ammonium Citrate in the Determination of Phosphoric Acid. *Ibid.*, pp. 427-443.

I. — As bone superphosphates have a higher commercial value than other phosphatic fertilisers they are naturally more subject to adulteration. The author proposes a simple method to determine such adulteration which, though not general, gives useful and sometimes decisive results.

PRELIMINARY TESTS. — A little of the substance is carefully charred in a porcelain dish then calcined in a platinum dish which is removed now and again from the flame. Pure bone superphosphate gives off no white

steam. When, after prolonged calcination, the substance is still incandescent, pure bone superphosphate should not give a deep yellow colour which subsequently disappears, but should remain whitish or, at the most, yellowish. After cooling the calcined residue should remain white or have a pale reddish tinge. It is completely soluble in warm 10 % hydrochloric acid or, should a very small part remain undissolved, the solution should become perfectly clear after standing a little while.

QUANTITATIVE AND QUALITATIVE TESTS. — The moisture, total P_2O_5 , water and citrate soluble P_2O_5 , total SO_3 , and residue insoluble in aqua regia are determined. Reducing the results to a dry matter basis at 100°C the values are:— $ST = \frac{\text{total } SO_3}{\text{total } P_2O_5} \times 100$ and $SS = \frac{\text{total } P_2O_5}{\text{soluble } P_2O_5} \times 100$. In good bone superphosphate these values should not exceed 130 and the difference $ST - SS$ should not be great. If the values of SS and ST are much below the minimum of 110 the purity of the product is doubtful and precipitated phosphates have probably been added. A percentage of 1.3 for the residue insoluble in aqua regia is already high.

In some doubtful cases the following *summary tests* may be useful:— see whether the aqueous solution gives a strong reaction to chlorine (precipitated phosphates); observe with a magnifying glass whether the water-insoluble residue contains carbon particles (ashes, etc.); test whether the superphosphate effervesces with acids; in special cases determine the pyrophosphoric acid (large quantities show the presence of pyrophosphates or superphosphates derived from them).

II. — The authors studies the value of determining phosphoric acid in superphosphates and basic slags by the ammonium citrate instead of the molybdate method. It was shown that, in the case of basic slag, the citrate method may sometimes lead to serious errors, although there are two sources of error which often tend to balance each other — precipitation of magnesium ferrites or citroferrites and incomplete precipitation of phosphoric acid. If the results disagree and the precipitates are not perfectly white and amorphous after calcination, it is possible, by estimating the iron, to determine whether errors are due to its presence. In such a case, elimination of the iron before precipitation by means of "cupferron" (ammoniacal salt of nitroso-ferri-hydroxylamine) might give reliable results. Nevertheless, this method is not generally applicable, in practice, to commercial analyses.

In the rarer cases, where iron or aluminium phosphates are concerned, the citrate method is not applicable. The principle consisting in precipitating phosphoric acid in the presence of iron or aluminium in any case or at any concentration, by preventing the precipitation of these metals by citric acid may give rise to grave errors.

The existence of the phenomena studied by the authors does not compromise the present citrate method for estimating P_2O_5 in superphosphates except in a few exceptional cases of superphosphates rich in aluminium. Nevertheless these phenomena should be borne in mind in doubtful cases. The facts studied show that the choice of the concentration and quantity of solutions to be used fixed by the Italian official method is very happy, as

different amounts of ammonium citrate and magnesium mixture might give rise to great difficulties. The authors are, however, of opinion that, in view of the influence of its concentration on the formation of abnormal precipitates, the composition of the magnesium mixture should be more exactly fixed.

1210 - **The Production and Consumption of Copper Sulphate and Copper Products in Italy** (1). -- FASOLATO, N. (Inspector of Industry and Work at Turin), in the *Bollettino dell'Ispettorato dell'Industria e del Lavoro*, Vol. VIII, Nos. 1-2, pp. 36-64 + 3 Diagrams. Rome, 1917.

The author's paper entitled "*Cenni sommari sugli impianti per la fabbricazione del solfato di rame esistenti nel Regno (Continente)*" (Notes on the Copper Sulphate Factories in Italy) gives information of the copper sulphate and "Caffaro paste" industry in Italy.

In the manufacture of copper sulphate refined or commercial copper is used, besides sulphuric acid, and, as accessories, electrolytic copper, scrap copper, cupriferosus sand, cement copper and copper slag.

The process of manufacture may be outlined thus:—Copper—> urnaces—> tanks for granulating the copper—> towers for treatment with sulphuric acid or other acids—> crystallisation vats—> washing and centrifugalisation of the sulphate. To produce 100 lb. of copper sulphate are required, theoretically, 25.53 lb. of pure copper and, in practice, 25.78 lb. of 99 % commercial copper.

"Caffaro paste" is a fungicide with a basis of oxychloride of copper prepared by the "Società elettrica ed elettrochimica del Caffaro" by treating copper in a special apparatus with chlorine (by-product from the Solvay process for the preparation of caustic soda) and transforming the copper chloride obtained into oxychloride in special mixing-mills. The recent works can produce 98 400 cwt. of "Caffaro paste" containing 16.1 to 16.5 % of copper in seven months. The consumption of this paste during twelve months (from August till the end of July of the following year) was:—1913-14, 10 190 cwt.; 1914-15, 25 085 cwt.; in 1915-16, 45 080 cwt. The principal markets are Emilia, Piedmont, Venetia, Tuscany, Lombardy, Marche, Apulia and Sicily.

In Italy there are 17 factories producing copper sulphate, including that of "Caffaro paste". During the year 1915-16 their daily output was 6 820 cwt, representing 80.5 % of the declared production capacity, 346 cwt. These 17 factories belong to 11 firms and are not distributed in conformity with the needs of the districts for, whereas those of Piedmont and Liguria, where 8.3 % of all the Italian vineyards is situated, supply 65 % of the total production, those of Lombardy and Venetia, where there is 20.7 % of the vineyards, produce 19.4 %, and those of central and southern Italy, where there is 71 % of the total vineyards, produce only 15.6 %.

The following table shows the trade in copper sulphate.

(1) See R., 1911, No. 108, (Ed.)

	Averages for the years 1904-1914	Year 1914-1915	Year 1915-1916
Production of Italian factories	759 250 cwt.	807 527 cwt.	1 471 139 cwt.
Importation into Italy	429 041	259 662	127 180
<i>Total quantity available</i>	1 288 296 cwt.	1 067 189 cwt.	1 598 319 cwt.
Exportation from Italy	26 679	5 860	112
<i>Estimated consumption in Italy</i>	1 176 610 cwt.	1 077 089 cwt.	1 607 148 cwt.
Importation, in percentage of the estimated consumption	39 %	26.5 %	8 %

It may be admitted that each year Italy consumes on an average 1 182 800 cwt. of copper sulphate, with a maximum, which is not likely to be exceeded, of approximately 1 608 000 cwt. estimated for the season 1915-16 (1).

The 17 factories already mentioned are capable of producing, in 173 working days, all the copper sulphate required for consumption in normal times and, in 234 days, the amount necessary for years of maximum consumption. Estimating that each factory can give 250 working days each year, the Italian factories should be able to produce over 1 706 000 cwt. of copper sulphate, which would be sufficient to supply the maximum consumption as well as to export about 108 000 cwt. There are probably many reasons why, in spite of the large production of the Italian factories, copper sulphate is imported from abroad, but the author holds they may all be eliminated, and it is especially important to do so because when importing copper sulphate the crystallisation water (which represents over $\frac{1}{3}$ of the weight of the salt) is included in the payment, so that it is much more profitable to import the corresponding quantity of metallic copper.

The chief expenses in the manufacture of copper sulphate are:—cost of copper delivered to the factory (including freight, transport from Genoa to the factory, and unloading), cost of manufacture, interest and other expenses for the capital used in buying the copper, brokerage fees incurred in buying the copper, eventual rising of prices to balance the drop which may occur the following season in the price of prepared sulphate. The profit is obtained from the difference between the estimated cost of the copper sulphate and its selling price. A table of the prices of copper sulphate, illustrated by a diagram, clearly shows the greatly preponderant influence exercised on them by the cost of the metallic copper.

(1) See the half-yearly reports published by the International Institute of Agriculture under the title: *International Trade of Fertilisers and Chemical Products Employed in Agriculture*. (Ed.)

Fig. 11. — The Relationship between the Constituents of the Ashes of Plants Diversely Fertilised.—LEONCINI, G., in *R. Università di Pisa, Istituto di Chimica agraria, Studi e Ricerche*, Pt. 22 (1909-1914), pp. 225-245. Modena, 1917.

This paper describes preliminary investigations into the influence of certain elements and radicals added to the soil on the elements of the ashes of the plants grown in such soil. The investigations were limited to determining whether the amount of calcium and magnesium absorbed by the plant as well as their ratios, may be modified in the ash by increasing the quantity of certain elements and radicals assimilable by the plant in the soil.

Duplicate tests were made in two series of six pots each containing 10 kg. of ordinary field soil to which had been added calcium nitrate and magnesium nitrate, so that its content in these two bases should be increased. Maize was first grown, then buckwheat without further addition of fertilizer. Each series of six vases was made up as follows:—

No. 1)	Calcium nitrate + magnesium nitrate
No. 2)	" " + " " + disodium phosphate
No. 3)	" " + " " + potassium sulphate
No. 4)	" " + " " + bi-potassic phosphate
No. 5)	" " + " " + manganese sulphate
No. 6)	" " + " " + ferrous sulphate.

RESULTS. — An examination of the quantity of certain mineral constituents of the ashes shows that, under the conditions of the experiment, there would be a close relationship between the composition of the ash and the fertilizer, especially as concerns the Mg (magnesium) and PO_4 (phosphoric) ions, a fact already well known. The relationship between the Mg and PO_4 ions is greatly influenced by the abundance of the K (potassium) ion in the soil, and probably by a larger assimilation of potash. As the assimilation of magnesium is much influenced by the action of the potassium ion the assimilation of phosphoric acid must also be influenced, not only by the calcium and magnesium ions, but also by the potassium ion.

Under the experimental conditions, in the presence of large quantities of calcium and magnesium, cultivated plants tend to assimilate, in proportion to green matter, the same quantities of PO_4 ion, whether the soil has received phosphatic fertilizer or not. If the soil has received potassic salts as well, the quantities of magnesium assimilated vary considerably. The addition of phosphoric acid compounds to the soil causes a slight decrease in the assimilation of calcium ion in proportion to the green matter of the plant.

CONCLUSIONS. — Four ions — PO_4 (phosphoric), Mg (magnesium), Ca (calcium), and K (potassium) — appear to be fairly definitely connected with each other with respect to assimilation by plants. In order to decide the question the quantitative tests must be extended to a large number of elements by varying the fertilisers more rationally and comparing the variations of the assimilable element with the quantitative variations of the salts added to the soil. The author is now carrying out such experiments.

1212 — Relation between the Total Phosphoric Acid and that of the Lecithins in Different Varieties of Peas. — HALÁSZ, P., in the *Biochemische Zeitschrift*, Vol. LXXXVII, Nos. 1 and 2, pp. 104-106 + 3 Tables, Berlin, 1918.

To determine the relation between the total phosphoric acid content and the phosphoric acid content of the lecithins in different varieties of a leguminous plant the author analysed the seed of different varieties of peas. He found that, in certain varieties, the lecithin content may reach 2.34 % and that the varieties most rich in lecithins are those the ripe seed of which is green, i. e., those rich in chlorophyll. These varieties contain relatively little starch. The yellow seed varieties are less rich in lecithins, but contain more starch.

There is a close relation between the total phosphoric acid content and the phosphoric acid content of the lecithins. The first is six or seven times greater than the second (six times more in peas rich in starch grains and seven times more in green peas rich in lecithins). If the total phosphoric acid content of a variety of pea be known it is, therefore, possible to determine approximately its lecithin content.

1213 — "Sarthamine" and "Genisteine", New Alkaloids from the Scotch Broom.

— VALEUR A., I. On the Presence of a fixed Alkaloid in the Scotch Broom, in *Comptes Rendus de l'Académie des Sciences*, Vol. CLXVII, No. 1, pp. 26-28. Paris, July 1, 1918.

— II. On a New Volatile Alkaloid in the Scotch Broom, *Ibid.*, No. 4, pp. 163-164. Paris, July 22, 1918.

I. — Only very rarely is one alkaloid found in a plant; it might almost be said that plurality is the rule. If there are exceptions it is because one of the alkaloids is present in such a preponderating quantity that the isolation of the others presents serious difficulties. This was the case with nicotine, for long considered the only alkaloid in tobacco, until M. AMÉ PICTET showed the presence of several other alkaloids in crude commercial nicotine. The same took place with *sparteine*, extracted by STENHOUSE in 1851 from the Scotch broom (*Sarothamnus scoparius*) and which appeared to be the only alkaloid present.

The author has isolated from the two last mother-lyes obtained in successive crystallisations of *sparteine*, when they are no longer fit for obtaining the salt by concentration, two new bases, one fixed, one volatile. The first, called *sarthamine* by the author, is considered in the present note.

The author describes the extraction method by which he obtained a white, well crystallised product by a combination of chloroform and the new alkaloid, and fine white crystals obtained by a combination of ethyl alcohol with the alkaloid.

The formula of *sarthamine* is $C_{15}H_{24}N_2$, that of *sparteine* being $C_{15}H_{20}N_2$.

Sarthamine has a remarkable facility of combining with certain solvents; it combines with methyl alcohol and with benzene, giving crystalline compounds. The author was unable to obtain the base free in the crystalline state. *Sarthamine* acts as a monoacid to phthalic anhydride. The cold sulphuric solution clearly reduces a weak solution of potassium

permanganate; the base is, therefore, not saturated. It is an isomer of spartyrin, a base obtained by the careful oxidation of sparteine.

The author concludes: — 1) given the action of the high temperature (250° C) used in extracting sarothamnine, it is possible that the base itself does not exist in the broom, but is produced by the decomposition or transformation of an alkaloid, possibly oxygenated; 2) the formula given is provisory, as the alkaloid has not yet been completely studied.

II. — The author has isolated a fixed alkaloid, sarothamnine, from the mother-lye of the crystallisation of commercial sparteine sulphate. With an excess of soda lye, then exhaustion by ether, he was able to isolate, besides a large amount of sparteine, another volatile alkaloid, *genisteine*, a laevo-rotatory base with the formula $C_{16}H_{28}N_2$ which, with the addition of one molecule of water, forms a hydrate which may be obtained in large crystals.

1214 — Hydrocyanic Acid Content of the "Pe-gya" Burma Bean (*Phaseolus lunatus* var.) and its Estimation. — See No. 1227 of this Review.

1215 — Studies on the Evolution of the Sweet Principles of Sorghum: Sugar Content at the Various Stages of Growth and the Influence of Castration. — BERTHELOT, D. and TRANNOY, R. — I. The Sugar Content of Sorghum at the Various Stages of its Growth, in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXVI, No. 20, pp. 823-827, 1918. Diagram; II. The Evolution of the Sweet Principles of Sorghum and the Influence of Castration, *Ibid.*, No. 21, pp. 828-830, Paris, May 21 and June 2, 1918.

This paper deals with experiments, carried out at the Plant Chemistry Station of Meudon (department of Seine-et-Oise, France), on the sugar content of sweet sorghum (*Sorghum saccharatum*) at the various stages of its development. The seeds were sown on April 25, 1917, and analyses made from lots of five plants.

The primary reducing sugars (glucose and laevulose) were the first to appear, their quantity gradually increasing until towards August 24 the total quantity of both sugars was 4 to 5 %. Saccharose, which was not present at the beginning, appeared towards August 10 and developed at first at the expense of the already existing glucose and laevulose. This is a new example of the synthesis of saccharose in the plant at the expense of the primary monoses, in agreement with the process reported long ago by BERTHELOT and BRUNIER during the ripening of oranges (1).

On October 5 the saccharose content reached 14 % and remained between 12 and 14 % during 6 weeks, a content a little below that of common sugar beets. During this period the flavour of the juice, which was at first slightly acid and astringent, became pleasant and decidedly sweet.

During the second fortnight of November the tissues began to die; the vegetable juices mingled and the hydrating diastases they contain caused hydrolysis of the saccharose, which partially returned to the state of glucose and laevulose, so that the content of these two sugars was higher at the end of vegetation.

(1) *Comptes rendus de l'Ac. des Sci.*, Vol. 51, p. 1004, 1860. (Auber.)

This retrogression is yet more marked in cut sorghum, i. e., in the dead plant, and is especially rapid after a frost followed by a rise in temperature, which cause the rupture of the cellular membranes. This is one way in which sorghum is inferior to beet and sugar cane. Another not less serious one is the great difficulty in crystallising sorghum juice. When small saccharose crystals were mixed with the juice evaporated to a syrupy consistency, crystallisation did not finish for several weeks; at the end of six weeks it was still incomplete.

The density increases regularly with the sugar content. If the juice contained only sugar principles in solution, the excess ($d-1$) of the density over that of the water would be about proportionate to the sugar content. There is in the juice a quantity of saline principles, relatively weak as compared with the sugar principles, but sufficient to raise the density to 1.0025. The sugar content, s , from 8 % onwards at any rate, is fairly well represented by the formula $s = 2(d - 1.0025)$. This allows the variations in the sugar content to be controlled by an estimate of the density, i. e., by a much more simple process than a volumetric analysis with cupro-potassium solution or by a polarimetric measurement.

The suppression of the inflorescences has been recommended on the ground that it would increase the sugar content by avoiding the loss of that part of the sugar which changes to starch in the seed. The author's experiments on this subject were negative; castration did not increase the sugar content.

CONCLUSIONS. — It does not seem that, in normal times, sorghum can compete with the beet or sugar cane. The sweet juice of sorghum is inferior in many ways. First of all, it is difficult to crystallise, both by reason of the large proportion of so-called uncrystallisable sugars (glucose and laevulose) and the presence of gummy matter. Secondly, as soon as the plant is cut and the tissues die a large proportion of the saccharose again breaks up into glucose and laevulose; this phenomenon even occurs in the plant in the ground at the end of vegetation. Cut sorghum, is, therefore, more difficult to keep in silos than beet or cane, and treatment must not be postponed too long.

From a botanical point of view it must be noted that sorghum is reproduced annually from seed and is not so regular in growth as beet, which is biennial, or cane, which is reproduced vegetatively.

Sorghum is, however, a very hardy plant, easy to cultivate, which does well even in the north of France, and the sweet juice, which may be extracted with presses at home, and can be used unprepared, as a syrup, would be a useful addition in the household under the present conditions caused by the war.

1216 — **The Effect of Tobacco Smoke and of Methyl Iodide Vapour on the Growth of Certain Microorganisms** (1). — LUDWIG, C. A., in the *American Journal of Botany*, Vol. V, No. 4, pp. 171-177 + Bibliography of 7 Publications, Lancaster, Pa., April, 1918.

During experiments on bacteria and fungi the author observed the

(1) See No. 1220 of this Review. (Ed.)

action of tobacco smoke and methyl iodide vapour on the development of the following micro-organisms: — *Bacillus subtilis*, *B. pyocyaneus*, *B. Kiliensis*, *B. rubidus*, *B. melonis*, *B. mycoides*, *B. campestris*, *Pseudomonas radicicola*, *B. carotovorus*, *Oidium lactis*, etc. The influence on each of these is described.

It may be concluded that tobacco smoke is more or less toxic to the micro-organisms used but, in view of the very variable composition of tobacco smoke it is difficult to determine to which substance or group of substances the toxic action is due. When tobacco smoke had been passed through one or more wash bottles its toxicity is much smaller. This suggests that certain substances which can be condensed or dissolved in water take part in the toxic action.

Methyl iodide vapour causes, at first, a marked delay in development, followed by very vigorous growth, if of course, it is not sufficiently abundant to sterilise the culture medium.

1217 — **Relation of the Density of Cell Sap to Winter Hardiness in Small Grains; Investigations in the U. S. A.** — SALMON, S. C. and FLEMING, F. L., in the *Journal of Agricultural Research*, Vol. XIII, No. 10, pp. 497-506 + 1 Plate, Washington, June 3, 1918.

The death of plant tissues from cold may be due to: — 1) the formation of ice in the intracellular spaces; 2) physiological drought; 3) precipitation of the proteids; 4) desiccation of the protoplasm. In each case an increase in the electrolytic contents of the sap should increase the resistance of the plants to cold by lowering the freezing point and reducing transpiration. A close connection between the density of the sap and the resistance of the plant to low temperatures seems, therefore, probable. To study whether such a connection really exists in cereals the authors made a series of experiments with rye, wheat, emmer, barley and oats. The experiments were divided into three groups:—

Group I. — The sap was extracted by pressure after maceration or treatment with chloroform or toluene. A first determination, made with material collected on November 27, 1915, gave the following figures for the depression of the freezing point: —

	Freezing point
1) Rye.	— 1.044° C.
2) Durum wheat, Kharkof variety	— 1.236° C.
3) Soft wheat, Fultz variety.	— 1.076° C.
4) Emmer (<i>Triticum dicoccum</i>), Black Winter variety	— 1.012° C.
5) Barley, Tennessee Winter variety	— 1.117° C.
6) Oats, Culberson Winter variety	— 1.199° C.

No relation was observed between resistance to cold and sap density. It is true that the maximum depression of the freezing point is found in Kharkof wheat, which is very hardy, but Culberson oats, which are very sensitive to cold, also have a high coefficient, surpassing that of rye. These coefficients are, however, by no means constant, for in another determination made on December 17, 1915, Kharkof wheat had the lowest freezing point, —0.935°, whereas those for the other plants were: rye, —1.175°;

Fultz wheat -1.442° , barley 1.320° ; Wnter Turf oats -1.260° ; Culberson oats -1.445° .

Group II. — Results similar to the preceding ones were obtained without extracting the sap from the plants. The leaves were wrapped round the thermometer bulb, which was then placed in the freezing mixture. Three successive determinations were made:— 1) January 16, 1917: rye, -3.56° ; barley, -2.59° ; 2) January 19: Kharkof wheat, -3.47° ; rye, -3.58° ; 3) January 27: Kharkof wheat, -2.17° ; Fultz wheat, -2.06° ; rye, -2.10° . The depression of the freezing point is, therefore, greater than for extracted sap. The differences between the kinds of grain do not, however, indicate any relation between the sap concentration and resistance to cold.

Group III. — A study was made of the effect on the depression of the freezing point of the turgidity of the tissues which, all else being equal, has a tendency to lower the resistance of plants to cold. Wheat and oat seedlings grown in greenhouses were carefully uprooted and divided into two groups:— 1) before making the determination the seedlings were exposed to sunlight for two or three hours at room temperature, so that the leaves wilted partly; 2) the roots were immersed in water so that the leaves remained turgid. The values found for the depression of the freezing point were:—

	Lot 1 Wilted plants	Lot 2 Turgid plants
Turkey durum wheat	-1.945°	-1.405°
Fultz soft wheat	-1.930°	-1.308°
Winter oats	-2.160°	-1.230°

The difference between the freezing point of wilted and turgid plants of the same species is much greater than that between those of different species of equal turgidity. There is, therefore, an inverse correlation between the turgidity of the tissues and concentration of the sap.

1218 — *The Action of Ultra-Violet Rays on Sugar Cane, Pineapple and Banana, in Hawaii.* — Tseji, T., in *The Louisiana Planter and Sugar Manufacturer*, Vol. LX, No. 26, pp. 413-414 — 1 Table, New Orleans, June 29, 1918.

The author made a prolonged study of the action of ultra-violet rays on plant physiology. In the paper under review he describes his recent investigations which show perfectly clearly the connection between the action of these rays and the formation of carbohydrates, acids and other compounds in sugar cane, pineapple, banana, and other tropical plants.

SUGAR CANE. — Perfectly normal sugar canes were grown in the dark at a temperature of 22°C .; they grew but became pale. Thirty days later they were divided into two lots, one of which was exposed to direct sunlight, the other to ultra-violet rays from a quartz mercury vapour lamp. The etiolated leaves subjected to the action of ultra-violet rays turned a deep green after $2\frac{1}{2}$ hours, whereas those exposed simply to sunlight kept their yellow, etiolated colour.

[1217-1218]

In another experiment three lots of sugar cane were planted. One was covered with coloured glass (to intercept 50 % of the ultra-violet rays of the sunlight), the second was exposed normally to sunlight, and the third to the combined action of the sunlight and that of the mercury vapour lamp. These three lots received equal amounts of fertiliser. After several months the second lot was found to contain 30 % more sugar than the first, and the third lot 8 % more than the second. The increase in the weight of the sugar of each lot respectively in a given time points to the possibility of reducing the 20 months normally required for each sugar harvest to less than one year by the use of ultra-violet rays.

PINEAPPLE AND BANANA. — Pineapples exposed to the action of ultra-violet rays ripen more rapidly than those exposed to sunlight only. Pineapples were subjected to the action of ultra-violet rays for 40 minutes each morning; the fruit was riper, more juicy and larger than that exposed to sunlight only. The same favourable action was observed on the banana. Banana leaves and stalks which had been cut and placed in water kept their original freshness even after two weeks when they had previously been subjected to the action of ultra-violet rays, whereas other untreated material was faded completely after six or seven days. The author sees in this a means of preventing the deterioration of exported bananas, but lays stress on the care necessary in the treatment as the distance, duration and intensity have to be very carefully regulated to prevent bad effects.

PRACTICAL SOURCES OF ULTRA-VIOLET RAYS. — The ultra-violet rays of sunlight are quickly absorbed by the atmospheric gases, and only a small proportion of them reaches the surface of the earth. The use of mercury lamps is too expensive for practical application. The author, therefore, has attempted to devise more economical methods. In his latest system the ultra-violet rays are derived from small carbon rods impregnated with sodium tungstate, uranium nitrate, ammonium molybdate and titanous chloride.

1219 — **Physical Factors of Tropism.** — DUFÉRENOY, J., in the *Revue générale des Sciences*, Year XXIX, No. 15-16, pp. 430-451. Paris, August, 1918.

The numerous investigations into tropism have shown the direction and intensity of geotropism and phototropism to depend:— 1) for a given individual, on the physical factors of the environment; 2) for given ecological conditions, on the physico-chemical properties of the cellular constituents of the individual.

Heliotropism may be modified by internal secretions and traumatic and parasitic actions affecting cellular nutrition. Lateral branches of trees which are normally horizontal may become geotropic when the top is destroyed or if attacked by parasites. For example, lateral branches of pine attacked by *Accidium clatinum* acquire a negative geotropism, whereas branches of Scotch pine, cluster pine and spruce, borne on a level with galls of *Coccus resinifans* on the trunk, become positively geotropic.

LOEB, having observed the geotropic curve to be closely connected with the presence and position of leaves on the stalk, deducted from this the hypo-

thesis of the existence of special substances, or geotropic "hormones" that pass from the leaf to the tree, thus causing its geotropic curve.

The author considers this hypothesis neither justified nor necessary. In many completely leafless plants the floral stem curves even more rapidly than in plants with leaves. The author has made a new study of the question and his results lead him to interpret geotropic curving more simply:—

It is the result of unequal surface growth. The rate of geotropic curving and the rate of growth depend on the turgescence of the tissues and are, therefore, proportionate to the rate of absorption of water. It is for this reason that the curving and growth, rapid in stems standing in water, are slower in those standing in saline solutions and absent in plants deprived of water.

1220~ Artificial Budding of Roots.—MOLISCH, H., in the *Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften in Wien, Mathematisch-naturwissenschaftliche Klasse, Abteilung I*, Vol. CXXVI, Pt. I, pp. 3-13 + 2 Plates. Vienna, 1917.

Although much work has been done on causing artificially the budding and growth of leaves (1) little attention has hitherto been given to this artificial budding of roots and few observations have been made on the periodical formation of roots in perennial plants (2). Moreover, the few results published do not, as a rule, agree and make it impossible to determine whether, during the winter, the roots enter a period of rest independent of outward conditions or whether they do not develop in winter as a result of unfavourable environment. If the branches of species with a marked tendency to produce adventitious roots no longer show this tendency in autumn or winter, *in spite of the presence of factors favourable to growth*, and demand some method of forcing before showing it, the hypothesis of rest independent of outward conditions, or "spontaneous" rest, would be confirmed. The author attempted to verify this by the following method:—freshly cut branches, one to three years old, of species easily producing adventitious roots (*Salix*, *Populus*, *Philadelphus coronarius*, *Viburnum Opulus*) were subjected during September, October and November to the action of substances called by the author "Treibstoffe" (substances causing budding)—hot water, tobacco and paper smoke. After treatment the branches were exposed for one or two hours in the open air, then placed in a greenhouse at a temperature of 12 to 20°C, or in a thermostat at a temperature of about 25°C.

A comparison of the branches subjected to treatment and the control branches showed that exposing the branches to tobacco smoke for 24 hours, to paper smoke for 48 hours, or to a warm water bath (at 30°C.) for 12 hours causes the leaves to fall more rapidly and the appearance, a few weeks later, of numerous adventitious roots. The control branches showed only a few small adventitious roots or none at all as may be seen from the photographs reproduced. The author concludes that there is a period during which the roots have, so to speak, no further tendency to grow; this is their period of

(1) See R. Jan., 1916, No. 62. (Ed.) — (2) See R. April, 1917, No. 313. (Ed.)

rest. This period does not, however, always depend on the presence of unfavourable factors, but is very often "independent", such as that of the budding of leaves, since, for two kinds of organs the same "activating" substance ("Treibstoffe") may shorten the period and cause budding.

1221 - **The Influence of Pollinisation and other External Factors on the Floral Organs and the Flowering Period; Research in Japan.** — MORITA, KOICHI, in *The Botanical Magazine*, Vol. XXXII, No. 375, pp. 39-52 + 6 Tables + 10 Figs. Tokyo, March, 1918.

The paper describes research work on the influence of pollinisation and other external factors (mechanical and physico-chemical) on the modification of the floral organs and the duration of the flowering period. Many tropical Orchidaceae present certain physiological phenomena which show this influence. The author chose a Japanese species — *Cymbidium virens* — which responds to the following factors by fairly strong reaction:—

1) INFLUENCE OF POLLINISATION. — This influence is felt in several ways:— the flowering period is lengthened; the stigma closes completely; the gynostemium swells; the ovary swells and lengthens.

2) INFLUENCE OF DEAD POLLEN AND POLLEN EXTRACT. — Dead pollen, killed by boiling water or chloroform, when placed on the stigma also causes it to close and the gynostemium to swell, but does not influence the duration of flowering. The author concludes that dead pollen contains active principles which are very stable with regard to heat and chloroform. For this reason he studied the influence of these extracts (small balls of cotton soaked in pollen extract obtained with hot, distilled water, placed on the stigma cavity) and found the influence to be the same as that exercised by dead pollen, except that the gynostemium does not swell.

3) INFLUENCE OF MECHANICAL FACTORS. — The placing of grains of sand on the stigma, or the artificial wounding of the gynostemium, have no effect on the flower of *Cymbidium virens*; this is contrary to the results obtained with other tropical species.

4) INFLUENCE OF THE POLLEN OF OTHER PLANTS. — Pollen from other species of the same family (Orchidaceae) has, so to speak, the same effect as pollen from the same species. On the other hand, pollen belonging to species of other families (*Prunus*, *Narcissus*, *Salix*, etc.) give absolutely negative results.

5) INFLUENCE OF CHEMICAL MATTERS. — Mineral matter has no effect; organic matter (fatty acids and certain sugars) seem to have some effect on the stigma, but the reaction has not yet been clearly demonstrated.

1222 - **Experiments on "Pneumatocarps".** — BAUMGAERTEL, O., in the *Sitzungsberichte der Kaiserlichen Akademie in Wien, Mathematisch-naturwissenschaftliche Klasse, Abteilung I*, Vol. CXXVI, Pt. I, pp. 13-40 + 4 Figs. + 1 Plate + Bibliography of 20 Publications. Vienna, 1917.

The author undertook a series of experiments on fruits which, as a result of internal gas pressure, present an abnormal growth due to the swelling of the pericarp. The author calls all fruits, of very different species, which show this inflation "pneumatocarps" ("Pneumatokarprien"), and he has studied the phenomenon from a morphological, biological and physiological point of view.

The presence of gas within the fruit may be ascertained by pressing with the finger or pricking holes in the skin. The gases seem to be formed by the combustion of carbohydrates owing to respiration. DE NEGRI's analytical investigations gave the following figures for the composition of these gases: — CO_2 , 9.88 %; O, 16.59 %; N, 73.53 %. If these values are compared with those given for atmospheric air (CO_2 , 0.04 %; O, 20.81 %; N, 79.19 %) the gas in the pericarp is seen to be much richer in CO_2 . Respiration takes place in all the tissues where carbohydrates can accumulate. The author carried out a microscopical study of the tissues of "pneumatocarps" in order to determine the connection between the histological conformation of the fruits and the formation of the gases they contain. His studies on the following species:— *Astragalus Cicer* L., *Colutca halapica* Lam., *C. orientalis* Mill., *Nigella damascena* L., *Staphylea Bumalda* D. C., *S. pinnata* L., led him to distinguish three types:—

1) *Staphylea* TYPE:— centre of respiration in the mesocarp and osmotic phenomena through the endocarp.

2) *Nigella* TYPE:— centre of respiration in the mesocarp and "setting free" ("Ablösung") of the impermeable endocarp on the one hand with formation of gas by the respiration of the embryos on the other.

3) *Leguminosae* TYPE:— centre of respiration first in the numerous embryos, then localised particularly in the meatic tissues of the placenta and funiculus, with the result that the endocarp may become the seat of respiration.

The biological importance of the internal air of "pneumatocarps" consists partly in forming a moisture-saturated environment favourable to the development of the embryos, and partly in causing the formation of fruit which is both as developed as possible and as light as possible. This is a great advantage if the action of the wind as a factor favouring reproduction be considered.

1223 — **Inheritance of the Characters of the Endosperm in Hybrids between Hard and Soft Wheats in the United States.** — FREEMAN, G. P., in *The Journal of Heredity*, Vol. IX, No. 5, pp. 211-226 + 5 Figs. Washington, May-June, 1918.

It is known that, in wheat grain with a high content of gluten as compared with that of starch, the constituents remain cemented together when the grain is completely ripe, thus giving it a compact texture and a translucent, glassy appearance. When the gluten content is not high enough to cement the mass of the endosperm completely the decreased volume of the grain is not sufficient to compensate for the loss in moisture so that air spaces occur and the grain remains soft and opaque.

The author distinguishes two types of soft grain according to the appearance and distribution of the air spaces:—

1) "true softness" type, in which the air spaces are finely scattered throughout the endosperm; it is only slightly affected by external factors.

2) "yellow berry" type, in which the air spaces occur in groups with well-defined margins; in these opaqueness may be confined to a small spot or include the whole endosperm.

The results are given of a series of experiments carried out to determine

the conditions governing the transmission of these characters. Numerous crossings were made between soft and hard wheats and the progeny analysed as far as F_4 .

I. — EXPERIMENTS WITH WHEATS OF THE "TRUE SOFTNESS" TYPE. The cross hard Algerian wheat 1 × Sonora 35, a soft American wheat, gave, in F_1 , plants with intermediate characters, in which the maternal and paternal characters graded into each other, passing in a regular series from almost hard to almost soft wheat.

Two hybrids were chosen from F_1 :—a) No. 16-1 with 23 % of hard grain and 77 % of soft and intermediate grain; b) No. 16-5, with 14 % of hard grain and 86 % of soft and intermediate grain. From each of these hybrids were sown separately:— 1) hard grain; 2) soft grain; 3) naturally mixed grain (soft, hard and intermediate). Table I shows the composition of the F_2 obtained.

TABLE I. — Composition of the F_2
of the cross hard Algerian wheat 1 × Sonora 35 soft wheat.

F_1 seed used for sowing	Number of F_1 plants with		
	all hard seed	hard, soft and intermediate seed	all soft seed
The hard seed { of No. 16-1 produced in F_1	12	12	1
{ of No. 16-5 " " " " " "	7	7	1
The soft seed { of No. 16-1 " " " " " "	—	14	3
{ of No. 16-5 " " " " " "	4	13	5
The mixed seed { of No. 16-1 " " " " " "	11	36	17
{ of No. 16-5 " " " " " "	19	39	10
Total progeny of the cross 1 × 35	682	1551	336
Percentage of plants per class	30 %	55 %	15 %

Although the progressive passage from one type to another makes the analysis and grading of the descendants difficult the following facts may be discerned:—

1) Selected hard seed tends to produce progeny with hard or mixed seed with a decrease or absence of completely soft seed.

2) Selected soft seeds tend to produce progeny with soft or mixed seed with a decrease or absence of completely hard seeds.

These facts become still clearer in the following generations. Thus, in 1915, a plant (No. 16-5-1-15) was isolated from the F_2 of No. 16-5 which had 28 % of hard seed and 72 % of soft and intermediate seed. Table II shows the composition of the F_3 obtained.

TABLE II. — *Composition of the F_3 of the cross hard Algerian wheat 1 × Sonora 35 soft wheat.*

F_3 seed used for sowing	Number of F_3 plants with		
	all hard seed	hard, soft and intermediate seed	all soft seed
The hard seed of No. 16-5-1-15 produced	39	8	—
The soft seed of No.	—	27	17

The F_3 of hard seed is, therefore, composed of plants with hard or mixed seed with *complete* absence of those with soft grain only. The descendants of soft seed are composed of plants with soft or mixed seed with *complete* absence of those with hard seed only.

Exactly the same results are obtained in F_4 . It may be assumed that plants with mixed grain types are heterozygous with respect to the factors determining the texture of the endosperm, whereas plants with only one type of seed are homozygous.

What are the genetic factors influencing the texture of typically soft endosperms?

The author admits the existence of two independent factors (contained in two different chromosomes) which govern the proportion of gluten and starch in the endosperm. They show incomplete dominance over their absence, so that the characters depending on it are all the more obvious as the number of determinants present in the endosperm is greater. In the case of double fertilisation there may be in the endosperm three pairs of determinants A and B (AB AB AB), from which, by an uninterrupted series of intermediate values, the formula *ab ab ab* denoting the complete absence of the determinants AB is obtained. Since the presence of at least three A's and one B produces typically soft seed, all the groups from *Ab Ab AB* to *ABABAB* would produce such seed. When there are less than three A's and B's the seed is typically hard; this is the case for all the groups *abab AB*, *Ab Abab*, *aBaBab* . . . up till *ababab*. In all other cases where successive reduction of the factors leads to three factors only, the seed is intermediate.

The grain may thus be divided into three groups:— 1) soft, 2) hard, 3) intermediate. Taking these considerations as a basis and representing Algerian hard wheat by the symbol ABAB and Sonora soft wheat by *abab*, the author draws up the genealogical table of the F_2 and F_3 . The values he deducts from it correspond very well with those found experimentally.

II. — EXPERIMENTS WITH SOFT WHEATS OF THE "YELLOW BERRY" TYPE. — This character is very sensitive to the action of external factors. In certain pure strains of hard wheats the percentage of "yellow berry" grains varies from one year to another. When the percentage of yellow

berries is small the opaque spots are small but when the percentage is high the spots are large and cover the whole endosperm.

The factors governing the appearance of yellow berry have not yet been defined or analysed. From their nature and behaviour it is, however, certain that they differ greatly from those governing "true softness" and are very sensitive to outside influence. There is no doubt that the tendency to produce yellow berries is inherited; this was proved by the experiment made from 1914-1916 with 145 pure strains of Turkey wheat. A comparison of the percentages of yellow berries in the different years of the experiments gave the following correlations:— 1914 and 1915: $+ 57\% \pm 4\%$; 1915 and 1916: $+ 33\% \pm 5\%$; 1914 and 1916: $+ 41\% \pm 5\%$. All these figures are more than six times greater than the probable error.

1224. — On a Case of Permanent Variation in the Glume Lengths of Extracted Parental Types and the Inheritance of Purple Colour in the Cross *Triticum polonicum* \times *T. Eloboni*, in England.— St. CLAIR CAPORN, A., in the *Journal of Genetics*, Vol. VII, No. 4, pp. 259-280 + 2 Plates. Cambridge, August, 1918.

The characters of the two parents used for the cross are:—

Triticum polonicum:—Average glume length, 29.23 mm. Grain white, long and pointed, with a deep furrow.

T. Eloboni. — Average glume length, 10.58 mm. Grain short, stumpy and hard; pigmentation of the cells of the pericarp.

A) GLUME LENGTH. — F_1 generation. — The glumes were intermediate in shape and size to those of the parents, but varied greatly above and below the average.

F_2 generation. — There were three types of glumes: — a) as long or short as those of the parents; b) almost as long or short as those of the parents; c) intermediate between those of the parents. In reconstructing the polygons of variations (1) with respect to glume length a curve with three distinct points is obtained, thus showing that segregation of the characters has taken place. According to Prof. BIFFEN (2) this curve results from the overlapping of three separate curves representing the lengths of 1) homozygous short, 2) long, 3) heterozygous short-long glumes respectively. This phenomenon is seen more clearly in F_3 .

F_3 generation. — The seed of 183 heterozygous F_2 ears were sown in separate rows. In F_3 170 rows were obtained containing sufficient plants to give the following classification:—

	Number of F_3 lines	
	found	calculated by the ratio 1 : 2 : 1
Short glumes	41	42.5
Short, medium and long (mixed).	87	85.0
Long glumes	42	42.5

(1) See R. Sept, 1918, No. 973. (Ed.). — (2) BIFFEN, R. H., in the *Journal of Agricultural Science*, 1905 (Ed.)

An examination of F_3 confirmed the observations made with F_2 , namely, that the numbers found agree very well with those calculated and with the ratio 1 : 2 : 1 of monohybrids.

A further fact proved unmistakably is worthy of attention. In plants with long glumes, such as those of the parent *Triticum polonicum* which reappear in the F_2 and F_3 , the average length of the glumes (24.15 mm.) is always below that found in the parent (29.23 mm.). Similar results are probably obtained with short glumed plants, with the difference that the average length of their glumes should exceed that of the parent *Triticum Eloboni*. There is reason to believe that this shortening and lengthening of the glumes observed in the long glumed and short glumed plants of the F_2 and F_3 remains unchanged throughout all the generations.

B) GRAIN COLOUR. — F_1 generation. — All the hybrids had the purple colour characteristic of *Triticum Eloboni*.

F_2 generation. — Grain with purple streaks on a light ground occurred. There were 28 plants with purple grain, 8 with streaked grain and 136 with uncoloured grain, corresponding to the ratio 3 : 1 : 12. The ratio is relatively simple, but the small number of purple-grained plants in spite of the dominance of this colour in the F_1 is surprising. F_3 is yet more complicated.

F_3 generation. — Numerous data on the colour of the grain are given and closely investigated. Nevertheless the author concludes that none of the ratios observed in the F_3 can compare with the ratio 3 : 1 : 12 obtained in the F_2 . None of the hypotheses put forward to explain these phenomena by multiplying the number of chromatic, inhibitory, developing factors, etc. give a satisfactory explanation and the problem of the grain colour in crosses between *Triticum polonicum* and *F. Eloboni* remains unsolved.

1225 — Experiments on the Structure of Common Rice and Gluten Rice, in Japan.

YASUKÉ, Y., in *The Botanical Magazine*, Vol. XXXII, No. 377, pp. 83-90. Tokyo, May, 1918.

By crossing common rice with gluten rice (1) an F_1 was obtained composed of plants with all the external characters of common rice and an F_2 with $3/4$ of the plants resembling common rice and $1/4$ similar to gluten rice. These facts seem to point to dominance of common rice, yet, an analysis of many F_2 plants showed that the grains of the "common rice" type were not all similar but could be sub-divided into two groups:—

Group 1. — The endosperm of the grain is translucent and when treated with an iodine solution of potassium iodide immediately turns blue. These are characters belonging to common rice and plants of this group must be considered *homozygous AA*.

Group 2. — The grains, with semi-translucent endosperms, give a red to reddish violet colour with iodine; they are intermediate between those of common rice, which are translucent, and those of gluten rice, which are opaque *BB*, and should be considered *heterozygous AB*.

The genetic data on descendants of grain which is considered hetero-

(1) Of the variety known in Cochin-China as "Nep".

zygous in respect of the above-mentioned characters, fully confirm the author's hypotheses. In six different cases the F_2 showed simultaneously plants of the "common rice" and of the "gluten rice" types, in the ratio 1:2:1 observed in cases of monohybridism. The general average obtained was 1056 plants of the "common rice" type, 1740 hybrids (heterozygotes), and 884 of the "gluten rice" type. The corresponding theoretical numbers were 910, 1820, 910.

In conclusion, the above-mentioned facts seem to show that the dominance of common rice over gluten rice is incomplete, but to prove this definitely, the F_1 and F_2 must be analysed. This the author proposes to do.

1226—The Inheritance of Tight and Loose Paleae in *Avena nuda* Crosses, in England.

— ST. CLAIR CAPORN, A., in the *Journal of Genetics*, Vol. VII, No. 4, pp. 229-246 + 6 Figs. Cambridge, 1918.

Results of a series of reciprocal crosses made between *Avena nuda* and three varieties of ordinary oats — Thousand Dollar, Ligowo, and Nubian Black — with the intention of studying the inheritance of the characters "tight" and "loose" paleae.

CHARACTERS OF THE PARENTS. — *Avena nuda*. — Long, dangling spikelets with as many as 9 flowers; loose, free, membranous white and grey paleae from which the grains are easily detached.

1st. The three following varieties have tight paleae:— Thousand Dollar Oat. — Two-grained spikelets, rarely 3- or 4-grained. Inner paleae thin but stiff, the outer thick and curled round the edges of the inner.

Ligowo Oat. — Like Thousand Dollar, save that it tends more to form 3-grained spikelets and its grain is plumper.

Nubian Black Oat. — Is a shorter strawed out than the two previously described.

F_1 GENERATION. — The panicles contained a varying proportion of many-flowered spikelets of the "nuda" type, and, in the basal regions, the 2-flowered spikelets predominated.

The paleae showed every conceivable gradation from the "pure tight" of the tight grained parents to the wholly membranous paleae.

The percentage of "pure tight" ranged from 26.4 to 68.7%; that of the "pure looses" from 7.8 to 46.8%. The rise of the one appears to be correlated by the fall of the other, not only when different plants are compared, but also in different zones of the same plant, as are shown in the proportions found in one plant:—

1st. node of the panicle	67.0 % pure tight	32.1 % pure loose
2nd. " " " "	45.8 %	20.8 %
3rd. " " " "	26.8 %	33.0 %
4th. " " " "	5.0 %	45.0 %
Last. " " " "	7.4 %	44.4 %

This gradual diminution in the number of tight paleae and increase in the number towards the tip is a tendency noticeable in every heterozygous panicle.

In the case of Nubian Black \times *Avena nuda* the F_1 colour was a bright

brown sometimes overlaid with a faint greyish flush. This may be due to the fact that the black parent is really made up of at least 3 different kinds of blacks, represented zygotically by the formulae $BB\ B'B'\ GG$; $BB\ B'B'\ gg$; and $BB\ b'b'\ gg$, where B and B' are factors for blackness, and G for grey colour.

In the F_1 of the cross between *Avena nuda* and the white oats Thousand Dollar and Ligowo, the plants raised were a mixture of greys and whites, with dominance of grey in the cross grey \times white.

F_2 GENERATION. — This contained pure tights and mixed individuals. The proportion of plants with all grains tight were as follows:—

- 1) Out of 213 *Avena nuda* $\varnothing \times$ Thousand Dollar σ , 64 plants.
- 2) Out of 172 Ligowo $\varnothing \times$ *Avena nuda* σ , 49 plants.
- 3) Out of 133 *Avena nuda* $\varnothing \times$ Ligowo σ , 31 plants.

There were thus 518 plants with free paleae and mixed paleae, against 144 with all grains tight, in the ratio of 3 : 1, as was confirmed by further analysis.

F_3 GENERATION. — The plants of mixed type of the F_2 gave in the F_3 the following types:—

I. — *Pure tights*. — All the grains on the plants enclosed in tough, wholly sclerotised paleae.

II. — *Tight-containers*. — One or more "pure tight" paleae, the rest varied.

III. — *Hard backs*. — No "pure tight" pales. Paleae partly membranous, partly stiffened, the hard portion varying from a slightly thickened midrib to the stiffening of nearly the whole palea.

IV. — *Panulti-looses*. — As in type III but the hardening is never found above the lowest palea in any of the spikelets. These verge closely on the

V. — *Pure looses*. — All paleae absolutely membranous. These 5 types were distributed as follows in the F_3 :—

F_2 crosses	F_3 Plants					Total F_3 plants
	Type I	Type II	Type III	Type IV	Type V	
Thousand Dollar $\sigma \times$ <i>Avena nuda</i> \varnothing	283	610	161	61	18	1133
<i>Avena nuda</i> $\sigma \times$ Ligowo \varnothing	163	341	113	24	16	657
Ligowo $\sigma \times$ <i>Avena nuda</i> \varnothing	164	359	95	25	12	655
Totals	610	1310	369	110	46	2445

As might have been expected the pure tights make up almost exactly $\frac{1}{4}$ of the total.

Type II is really a mixture of 2 distinct types; it contains some plants that never throw pure tights, as is shown on analysing the progeny. The author found that 78 out of 1310 are of Type II. On adding these 78 plants to the numbers 369 + 110 + 46 of Types III — IV — V, we get a total

of 603. In this way, the respective numbers of plants of types I, II and III — IV — V, i. e., 610 — 1232 — 603, would be in the ratio of 1 : 2 : 1, showing that *completetightness* is determined by a single independent factor.

But what is it that causes the heterogeneity of the 603 plants of the types III — IV — V, which have the one common property of being unable to give rise to pure tights? On adding the number of plants of Types IV and V, we get 156, or about $\frac{1}{4}$ of the total 603. This proportion shows that other factors must be coming into play, assumed by the author to be 3 in number: *X* = a factor capable of rendering *all* the paleae on the plant pure tight; *Y* = a factor capable of rendering some of the paleae on the plant pure tight; *Z* = a factor capable of rendering some of the paleae on the plant more or less sclerotised but never wholly tight.

All the pure tight forms must be homozygous to *X*, no matter whether they contain *Y* or *Z* or not. Similarly all plants which never throw pure tights must be recessive for *X* (their formula would be *xx*). On crossing these 2 types, we get a large number of *F*₁ combinations (e. g., *XYZ xYZ*; *Xyz xYz*; *XYZ xyz*; *XVZ xVz*), all with a constant feature: the heterozygosity of *X*. In the *F*₂ there is $\frac{1}{4}$ of pure tight plants, and $\frac{3}{4}$ of variably tightened paleae according as *Y* and *Z* are present both homozygously, both heterozygously, one homozygously and one heterozygously and so on, or both absent. It should be added that the functions assigned to the factors *Y* and *Z* are merely hypothetical.

NUMBER OF SPIKELETS. — Tight pales have the advantage of holding the grain and thus preventing it from being shaken out; it is thus a character of great agricultural value, which it would be desirable to combine with the many-flowered habit of the *Avena nuda* spikelets. Unfortunately the author has found that there is an absolute incompatibility between these two characters, as the food material which might be used to produce the additional grains is used up instead to strengthen the paleae.

COLOUR OF THE PALEAE. — There is no repulsion between grey or brown colour and pure tight paleae, though the author had previously thought there was, judging from the material studied.

1227 — Selection of a Type of "Pe-gya" Bean (*Phaseolus lunatus* var.) with a Low Prussic Acid Content, in Burma. — WARTH, F. J., and KOKOGYI, in the *Agricultural Research Institute, Pusa, Bulletin* No. 79, 11 pp. + 6 Tables. Calcutta, 1918.

The bulletin under review gives the results of a series of selection experiments aiming at the isolation of strains or types of "Pe-gya" (Burma bean, a variety of *Phaseolus lunatus*) poor in prussic acid so as to avoid, if possible, the cases of poisoning attributed to this bean by London firms.

One hundred "Pe-gya" plants were collected from the Sagaing district and the prussic acid (HCN) content of the seeds determined by the following analytical method:—

The glucoside was extracted from the finely-ground seed with alcohol. The alcoholic extract evaporated to dryness, was taken up with water, hydrolysed with dilute acid, then distilled over a water bath, air being bubbled through during the process. The hydrogen cyanide thus obtained was absorbed by 30 cc. of sodium bicarbonate solution. The distillate was then

brought up to a volume of 400 to 500 cc. with water, 30 cc. of normal potassium hydroxide and 16 cc. of an aqueous solution of ferrous sulphate added, and the whole shaken at regular intervals for three hours. The liquid was then acidified and left to stand for some days till the Prussian blue was completely precipitated. The precipitate was filtered, washed with a small amount of alkali and the Prussian blue re-precipitated. If the amount of Prussian blue was small it was determined colorimetrically, if large it was collected on a filter, ignited and weighed as ferric oxide (Fe_2O_3).

While making these determinations large differences were noted in the prussic acid content of the seed. For selection purposes eight plants were chosen, two with a low HCN content (0.0004 to 0.0012 %), two with a high content (0.0138 to 0.0347 %) and four with a medium content (0.0012, 0.0030, 0.0112 %).

There was no difference between the size, shape, or colour of the beans; they all consisted of a mixture of brown mottled seed with seed of a more uniform brown. No correlation could, therefore, be found between the external characters and the prussic acid content which would simplify selection by avoiding long and difficult analyses. Seed from each of these eight plants was sown in three districts with widely different climates: 1) Mandalay, in the arid zone; 2) Hmawbi, in the wet Irawaddy delta zone; 3) Tatkon, in Central Burma, where the rainfall is intermediate.

Percentages of prussic acid in the seed of the parent plants and those of the descendants.

Parent plants	Descendants			
	Mandalay			Tatkon
	1st sowing	2nd sowing	3rd sowing	
Lot I . . . 0.0004 . . . 1	—	—	0.0008	—
2	0.0008	0.0012	0.0010	0.0015
Lot II . . . 0.0012 . . . 3	—	0.0016	0.0015	—
4	0.0016	0.0021	—	0.0017
Lot III . . . 0.0018 . . . 5	0.0016	0.0021	0.0021	—
Lot IV . . . 0.0022 . . . 6	0.0021	0.0027	0.0026	0.0027
Lot V . . . 0.0030 . . . 7	0.0028	0.0043	0.0062	0.0036
Lot VI . . . 0.0112 . . . 8	0.0038	0.0072	0.0146	0.0094
Lot VII . . . 0.0138 . . . 9	—	0.0249	—	—
10	0.0083	0.0242	—	0.0220
Lot VIII . . . 0.0347 . . . 11	—	0.0317	0.0317	—
12	0.0250	0.0314	0.0325	0.0311

The prussic acid content of the seed of the descendants obtained at each of these stations was determined by the method already given. The results are given in the above table together with those found for the parent plants of which lots I-II (poor in HCN) and VII-VIII (rich in HCN) had been

vided into two, the first with mottled seed, the second with uniformly brown seed; both these groups had been sown separately to determine whether any correlation existed between the difference in colour and the prussic acid content.

From this table it is seen that, in spite of the great differences in the climate and soil of the three stations, the seed with a low and that with a high prussic acid content always produced descendants poor or rich in prussic acid respectively.

CONCLUSIONS:— In spite of variation caused by climate and soil the prussic acid content of the "Pe-gya" bean is an inherited character which remains fairly constant in the descendants.

There is no correlation between the colour of the seed and its prussic acid content.

The best "Pe-gya" beans grown in Burma so far still contain a little prussic acid, but only half the amount found in the beans imported from Madagascar to solve the problem of decreasing this toxic principle.

1228 - Behaviour of the Hybrids of the Two Varieties of Peas "Siroendo" and "Sans Parchemin très large Cosse"; Experiments in Japan. — SICHERKEIT, N., in *The Botanical Magazine*, Vol. XXXII, No. 377, pp. 91-102 + 2 Figs. Tokyo, May, 1918.

The Japanese pea "Siroendo" and VILMORIN'S "Sans parchemin très large cosse" pea both have edible pods which have not the parchment-like lining common in many other varieties of peas with unedible pods. By crossing these varieties the author obtained in the F_1 hybrids of a totally different character from the parents, namely with hard, parchment-like pods which did not wilt when ripe but kept their stiffness and opened when twisted.

This rather rare phenomenon suggests the presence of two complementary factors which, being separated in the parents, have no effect, but when united in the hybrid cause the parchment-like thickening of the pods.

Should this be really so plants with stiff pods and others with soft pods in the ratio 9 : 7 should be found in F_2 . An analysis of 622 F_2 plants showed there to be 339 with hard pods and 283 with soft pods. The theoretical figures corresponding to the ratio 9 : 7 are 349.88 and 272.12 respectively. The agreement between the numbers found and those calculated is satisfactory, the deviation being + 10.88 and the probable error ± 12.37 .

An analysis of several F_3 plants showed:—

1) F_2 plants with soft pods produced exclusively plants with soft pods in the F_3 .

2) Of the F_2 plants with hard pods only some gave in F_3 descendants with hard pods (Group A), whereas the others gave a progeny of mixed plants, some having hard pods and some soft pods amongst which may be distinguished group B (with ratio of the two types equal to 9 : 7) and Group C (with ratio equal to 3 : 1). Numerous analyses showed the three groups A, B and C to be in the ratio 1 : 4 : 4 as is seen from the following data:—

Number of F_2 plants with hard pods	Descendants in F_3
68	$\left\{ \begin{array}{l} \text{Homozygous (with hard pods)} 7 \text{ of group A} \\ \text{Heterozygous} 61 \left\{ \begin{array}{l} 33 \text{ of group B} \\ 28 \text{ of group C} \end{array} \right. \end{array} \right.$

All these facts may be accounted for if it be admitted that the thickening of the pod is due to two factors separated in each of the parents, the factor **L**, producing the parchment-like tissue but unable to exercise this action except in the presence of **D**, which acts as a developer. The results of the cross might be formulated as follows:—

P (parents)	LLdd + DDll
F_1 (1st generation of hybrids)	DlDl
	DDLl + 2DDLl + 2Dlld + 4DLdl (1)
F_2 (2nd generation of hybrids)	DDll : Llld + ddll (2)
	2Dlld : 2Lddl (3)

By a study of the gametic formula of the F_2 it is possible to determine in advance the composition of the F_3 . The seven combinations of (2) and (3) represent individuals with a single factor which, in the following generation, will give descendants with soft (unthickened) pods. On the other hand, of the nine combinations of (1) only the first **DDLl** will give homozygous descendants composed exclusively of plants with parchment-like pods, whereas the others will produce mixed descendants in the ratio 9:7 and 3:1, as is seen from the following diagram:—

DDLl	with homozygous descendants
DLlL	$\left\{ \begin{array}{l} \text{with mixed descendants in the ratio 3:1} \\ \text{Dlld} \\ \text{DlDl} \end{array} \right.$
DLLd	
DlDl	

These formulae and figures agree perfectly with the data obtained by analysing F_2 and F_3 and confirm the author's hypothesis of the existence of two complementary factors, the fusion of which causes thickening of the pods.

1229 — **Alternate Wheats**. — DE VILMORIN, J., in *Feuille d'Informations du Ministère de l'Agriculture*, Year XXIII, No. 2, 16 pp. Paris, January 8, 1918.

"Alternate wheats" are wheats which may be sown alternately in autumn or spring as opposed to purely spring wheat, such as March chiddam, which cannot be sown in autumn. Wheats which may be considered alternate are:—

1) **WHEATS WHICH BE SOWN THROUGHOUT MARCH:—**

Blé des Alliés. — Grain sown at the end of February may ripen at the same time as winter wheat. Very fine, white grain. Does well sown in March in the north and centre of France.

Blé seigle. — Does well in very light soils which appear unsuited to rye.

Amidonnier blanc. — Suitable to cold, mountainous soils and does well where other wheats do not yield at all. Grows remarkably quickly. Yield not large.

Blé de Noël. — Suitable to any average good soil so long as it is healthy. Subject to rust. Does well in the south.

Barbu à gros grain. — Also does well in the south.

Saumur de printemps. — Grown in the plain of Caen.

2) WHEATS WHICH MUST BE SOWN BEFORE MARCH 15 AT THE LATEST:—

Bordeaux. — Does well in clay or vegetable soils as well as calcareous subsoils. Is most common in the South-West. In the West and Centre it covers half the area under wheat.

Japhet. — Does very well in February and often in March. Is suitable for sowing in spring where winter wheat has failed through frost. Much grown in Normandy.

Hérisson sans barbes. — Very resistant to heat.

3) WHEATS WHICH MAY BE SOWN IN FEBRUARY:—

Inversable. — Very early; adapted to the rich soils of the Centre and North. Is being grown more and more in France. Is particularly popular in Lombardy.

Dattel. — Is sown in February in the Pas-de-Calais and Somme departments. Ears a little late but gives a good yield regularly.

Gros bleu. — Does well in all soils; one of the most widely grown varieties.

Touzeille rouge de Provence. — Should be confined to the South as it is affected by cold. In healthy, calcareous soils in Provence and Languedoc it gives large yields.

Rouge de Saint-Laud. — A little sensitive to cold. Good variety for the West.

Richelle blanche de Naples. — For the south, and south-west districts and the calcareous soils of Berry. Slightly sensitive to cold.

Richelle blanche hâtive. — Excellent for the warm climates of the South and Algeria.

Blé de Gironde. — Beardless wheat. Tillers little but is very resistant to rust and smut. An excellent wheat for calcareous soils but very sensitive to cold.

Of the bearded wheats may be mentioned:—

Rouge prolifique barbu. — For the South. Adapts itself to any soil.

Rieti. — Gives good results in good soils and even in the medium soils of the centre.

Péanielle blanche de Nice. — Variety for the South, for rich, and preferably calcareous, soils.

Finally, with certain reserve, *Bon Fermier*. — An excellent, very widely grown wheat. It is often planted in February and commonly does well in spring, but its success at this season is not absolutely assured.

1230 — *Manitoba Wheat in 1918, in Algeria*. — TRABUT, L., in *Le Progrès agricole et viticole*, Year XXXV, No. 28, pp. 38-39. Montpellier, July 14, 1918.

Manitoba wheat has given good results this year in Algeria. Its resist-

ance to rust was remarkable, not one smutty ear was found in the experimental crops of the Botanical Station, the ears were longer than in the previous year, and the grain very fine. The seed received contained several varieties which it was necessary to separate and cultivate separately. At first sight five different varieties may be easily distinguished:—

1) *Manitoba A.* — White, more or less long ears with only a few short awns at the tip and three or four abortive spikelets at the base. This form is very similar to Marquis wheat, but behaved differently in summer cultural experiments. Marquis wheat, sown on July 15, 1917, gave a crop in October; it adapts itself well to irrigation and might be cultivated with maize. Manitoba wheat, under the same conditions, grew, but only gave a few thin ears.

2) *Manitoba B.* — Is distinguished by longer ears free from abortive spikelets at the base of the ear.

3) *Fife.* — Similar ear but red; probably one of the ancestors of Manitoba.

4) *Huron.* — Long white, bearded ear.

5) *Beardless hard wheat.* — Short, close ear. This hard wheat is of good quality but can only be judged when it has been isolated and grown on a large scale under varying conditions and compared with the native wheats. At first sight it appears to be a hard wheat suitable for dry countries and late sowing. It is a spring hard wheat. It is not very common in cultivated Manitoba wheat and the ears should be sought for and cut before the harvest.

1231 — **Rhodes Grass (*Chloris Gayana*) at Cuba.** — GOODMAN, D. S. and CENTURION, M. A., in the *Revista de Agricultura, Comercio y Trabajo*, Year I, No. 1, pp. 17-18, + 1 fig. Havana, January, 1918.

Mr. Goodman, of the Chamaguey Agricultural Station, and Mr. Cunliffe of the Santiago de las Vegas Station, grew Rhodes grass experimentally. The former found it entirely satisfactory, giving a high yield, being easily made into hay and accepted by live-stock without difficulty. The latter found it suitable to poor, light soils, and one of the most productive fodder plants during the dry season (but less so during the wet season). Sowing in July in poor soil gives, in January, about 1.2 tons per acre and, eight months later 1.6 tons per acre. The hay is excellent and keeps well.

1232 — **Cotton Growing in Venezuela.** — HENRY, F. A., in *Commerce Reports*, No. 193, pp. 642-643. Washington, D. C., August 17, 1918.

It is stated that the cultivation of cotton has been regularly carried on in Venezuela since the American Civil War. During the last 20 years the domestic cotton-manufacturing industry has developed considerably, and in spite of an import duty of 3.43 cents per lb. on raw cotton, the industries have frequently been obliged to import it from the United States.

The chief cotton-growing regions are near Valencia and also farther in the interior in the State of Portuguesa. It is also being grown near Barquisimeto, Coro, and in other localities. The high prices that have prevailed for the past two years for cotton and cotton goods have given

a great stimulus to cotton growing. The Government has aided in this movement by the distribution of seeds. The only figures the writer has available showing the quantity raised are the following, which are stated in metric tons (of 2 204.6 lb.) transported by the "Gran Ferrocarril de Venezuela". States of Aragua and Carabobo:— 1906, 254 tons; 1912, 3 002 tons; 1915, 1 140 tons; 1916, 1 223 tons; and 1917, 1 931 tons; the production in the State of Portuguesa for 1916 was 605 tons, and in 1917, 1 944 tons. These figures probably represent seed cotton and do not by any means include the entire production of Venezuela or even of the consular district of Puerto Cabello.

Official reports predict a bright future for the industry. The locusts have proved very disastrous at times and were largely responsible for the drop in production in the Aragua-Carabobo region from 1912 to 1915. It is thought that the climate and soil of Venezuela are better suited to the growing of "Upland" varieties of cotton than "Sea Island" or "Egyptian".

1233 - **The Production of Flax in Italy.**—*Ingegneria Italiana*, Vol. II, No. 35, p. 103. Rome, August 22, 1918.

Flax production in Italy has been rapidly decreasing during the last twenty years as a result of the ever-increasing competition with imported cotton. Whereas the production in 1895 was 392 000 cwt. of fibre, in 1913 it was only 39 000 cwt. In that year the Italian flax industry imported 39 000 cwt. of raw flax, mostly from Russia, 3 900 cwt. of carded flax and 78 400 cwt. of flax thread, chiefly from Belgium. The Italian flax industry consists preëminently of weaving. More than three-quarters of the raw material used are imported. The most important centres of production are Lombardy, Campania, Calabria, and the Abruzzi, which together supply about 75 % of the total national production. In the five-year periods 1870-1874, 1875-1883, 1890-1894 and the three years 1911-1913, the average annual area under flax and the amount of fibre were 200 445 acres, 453 318 cwt.; 168 854 acres, 389 508 cwt.; 129 883 acres, 381 270 cwt.; and 21 698 acres and 51 334 cwt. respectively.

1234 - **Experimental Cultivation of Jute (*Corchorus olitorius*), "Malva" (*Urena lobata*) (1), and Sunn Hemp (*Crotalaria juncea*) in Cuba.**—GIRAUDIER, A. in the *Revista de Agricultura, Comercio y Trabajo*, Year I, No. 1, pp. 5-7 + 5 Figs. Havana, January, 1918.

The sugar industry of Cuba uses 25 million sacks annually. The author was entrusted with the task of studying the possibility of making these sacks in the country. He brought from India seed of jute (*Corchorus olitorius*), "malva" (*Urena lobata*) and Sunn hemp (*Crotalaria juncea*) which he sowed and cultivated in different parts of the island, obtaining perfectly satisfactory results. If, however, these plants are to be grown on a large scale and compete with the Hindoo production, it is essential that prepa-

(1) *Urena lobata* = "paka" or Madagascan Jute (Madagascar) (See R., Oct., 1917, No. 919) = "piti-piti" (Guiana, Haiti) = "bun-vchra" (India). (Ed.)

ration of the soil and fibre be done by machinery. The author himself has invented a machine for removing the fibre.

1235 - Experiments in the Growing and Manuring of Coconuts in Ceylon. — *The Tropical Agriculturist*, Vol. L, No. 4, pp. 209-213 + 5 Tables + 2 Diagrams. Peradeniya, Ceylon, April, 1918.

The Committee of Agricultural Experiments of the Ceylon Agricultural Society publish the results of experiments in coconut growing carried out from 1915 to 1917 at Chilaw and Fitiakande. These results are summarised in the two appended tables: —

TABLE I. — *Results of experiments at Chilaw.*

Plot	No. of palms	Treatment	1915		1916		1917	
			Number of coconuts		Number of coconuts		Number of coconuts	
			per plot	per palm	per plot	per palm	per plot	per palm
1	47	Clean weeded	1931	41.1	2677	57.0	3262	69.2
2	72	Sulphate of ammonia $2\frac{1}{2}$ lb. per palm, 1915. Disk harrowed monthly, 1916, 1917	2804	38.9	4810	66.8	5267	73.1
3	89	Groundnut cake 6 lb. per palm, 1915. Crushed fish 6 lb. per palm, 1916, 1917.	3581	40.2	5014	56.3	5217	58.6
4	81	Steamed bone meal 8 lb. per palm, 1915, 1916, 1917.	4429	54.7	5800	71.6	5648	69.7
5	84	Sulphate of potash $2\frac{3}{4}$ lb. per palm, 1915, 1916, 1917.	3542	42.2	5225	62.2	5690	67.7
6	78	Ammonium sulphate 4 lb. per palm, 1915, 1916, 1917.	3829	49.0	4074	52.2	5114	65.5
7	92	Mineral mixture 6 lb. per palm, 1915, 1916, 1917.	3304	35.9	4714	51.2	5585	60.7
8	68	Lime 10 tons per acre, 1916 1917	2674	39.3	3300	48.6	4037	59.6
9	85	Mixed manure 10 lb. per palm, 1915, 1916, 1917.	3303	39.8	4499	52.9	5464	64.2
10	107	Mulched with husks in 1915, no treatment	2933	27.4	4616	43.1	4576	42.7
11	100	Mulched with husks in rings round palm	2861	28.6	4286	42.9	3713	37.1
12	101	Ploughed	2936	29.1	4691	46.1	3772	37.3
13	99	Ploughed and disked, 1917.	1859	18.7	3694	37.3	3384	34.1
14	46	Dug with "mamaty" (large hoe) and mulched with leaves	2338	18.4	2294	50.0	2054	44.6
15	81	Watered.	—	—	3087	38.1	2004	25.0
16	59	No treatment	2373	40.2	3222	54.6	3055	51.7

NOTES. — The soil of plots Nos. 11, 12, 13 and 14 is sandy. Plot No. 15 requires more than irrigation. Mulching round the palm is insufficient unless the soil is tilled yearly and then mulched.

The results show improved yields on half the experiment plots; the most satisfactory yields were obtained on plot No. 2. Liming plot No. 8

gave satisfactory results; it was decided to reduce the amount of lime to 10 cwt. in the future.

TABLE II. — *Results of experiments at Pitiakande.*

Plot	First treatment	Treatment in 1917	Number of coconuts per tree			
			1914	1915	1916	1917
1	Istate mixture	No manuring	64	103	76	71
2	Lime	Lime broad-casted	59	96	76	84
3	Ploughed twice yearly	Ploughed with village plough	37	68	55	76
4	Soil stirred monthly	Clean weeded and soil stirred	28	54	64	86
5	Cattle tied	Cattle tied to trees	44	55	71	77
6	Control (in grass)	Control (kept in grass)	43	48	40	42
7	Nitrogenous and potassic manure without phosphoric acid	No manure	49	59	53	59
8	Mineral mixture	No manure	49	55	55	49
9	Organic mixture	No manure	30	37	37	56
10	Control	Control (no <i>Tephrosia</i> planted)	27	34	30	28
11	Nitrogenous and phosphatic manure without potash	No manure	53	38	37	55

NOTES. — Weather conditions have a great effect. Plots 4 and 5 gave increasing yields from the beginning in spite of the weather conditions. The value of stirring the soil and of manure is clearly shown. Besides these results two tables are given, one of the yields obtained in experiments at Maha Iluppalama, the other of measurements of the development of leaves and trees made at Negombo from 1914 to 1917.

1236 — The Properties and Botanical Origin of "Cu-nâu". — CHEVALER, A., in the *Bulletin économique de l'Indochine*, Year XXI, No. 130, pp. 325-330. Hanoi-Haiphong, May-June, 1918.

The products known as "Cu-nâu" are of great commercial and industrial importance in Tonkin. The name is given to sub-spherical or oblong woody tubers varying in size from that of a fist to that of a head. They are rich in tannin and colouring matter somewhat resembling catechu and gambier or rather the dye obtained from mangroves of the genus *Ceriops*. These tubers are found in the forests of almost the whole of Tonkin and North Annam. In addition to those used for local consumption 5 000 to 8 000 metric tons are exported annually, chiefly to China.

In the Far East Cu-nâu is used exclusively for dyeing, especially for fishing nets. A cheap khaki dye, for dyeing coolies' clothes is also made from it. The tuber is soaked in water, grated, and left several days to ferment. To obtain a black colour the dyed material is buried in the bad-smelling mud at the bottom of ponds; the colour turns black but is not fast.

An analysis made by M. E. ROSÉ (Director of the Chemical Laboratory of the Pasteur Institute of Saigon) at the request of the Supplies Service,

[1235-1236]

gave the following results: tannins (CAFERNI method modified by SISLEY) 7.6 % of the tubers; soluble non-tannin 5.4 % of the tubers; insoluble non-tannin 6.8 %; total residue taken up by water 19.8 %. The Cu-nâu tuber, therefore, contains an amount of tannin similar to that contained in the bark of oak (6.8 to 13.6 %).

The Cu-nâu tuber is collected throughout the year in the forests of the middle and high districts of Tonkin. The retail price is about \$0.40 per 30 kg. and the wholesale price about \$1 per 100 kg. In the Delta the prices have already doubled as a result of transport expenses and middlemen's fees. The quantity exported represents only a small proportion of the production, the full amount of which is unknown, as much of it evades the verifications of the forestry agents.

There are several varieties of Cu-nâu, some belonging to the genus *Dioscorea*, others to the genus *Smilax* (Liliaceae). A description is given of different varieties examined locally by the author during his forestry tours of 1917-1918 (made to draw up an inventory of the forestry resources of Indo-China) with their names in the different dialects of Indo-China. The author does not consider it advisable to make Cu-nâu plantations for root production, but it would be useful to start small plantations for producing seed with which to re-plant the Cu-nâu forests which are disappearing. The Forestry Service should make controlled forest reserves of Cu-nâu to be exploited rationally in due course.

M. PH. EBERHARDT (1) has already pointed out the use to which Cu-nâu might be put in Europe as a substitute for catechu. After showing that Cu-nâu partly loses its colouring power on drying he suggests the local preparation of a concentrated extract by infusion followed by evaporation. The author agrees that this would be the best method of utilising this product. Should it be used for tanning, as advised by M. E. ROSÉ, it would have to be exported either in dried slices or as a solid extract similar to that prepared in Borneo from mangrove bark.

1237 - The Utilisation of Colonial Rubber. — Communication from the Institut Colonial of Marseilles, presented by M. LOUIS-DOP, Delegate of France, Vice-President of the International Institute of Agriculture.

At the request of M. LEPLAE, Director General of Agriculture of the Belgian Congo, the Belgian Colonial Ministry has commissioned M.G. VAN PELT, attached to the Government of the Belgian Congo, to cooperate with the Institut Colonial of Marseilles in a study of the preparation and conditioning of rubber. After having assisted in the investigations of the Rubber Laboratory of Delft, M. VAN PELT directed the technical work of one of the largest rubber plantations of Sumatra. The Institut Colonial of Marseilles intends to study first of all the measures to be taken so that African rubber may profit by the technical progress which has been made in the preparation of rubber.

The "Cahiers Coloniaux" of October 18, 1918, published by the Institut

(1) PH. EBERHARDT, *Les matières premières végétales et animales de l'Annam*, Hanoi, 1917, p. 66. (Author)

Colonial of Marseilles, contain a report on this subject by M. VAN PELT, and another one by M. E. BAILLAUD, Secretary-general of the Institut Colonial on the measures now proposed for supplying France with rubber. Extracts from the resolutions of the Office established in French Guinea to prevent fraud in exporting rubber from this country, from the Syndicate of Planters of Indo-China and the Professional Rubber Syndicate, complete this paper on the attempts made, with the active cooperation of the "Comité du Caoutchouc" of the Production Organisation Service of the Ministry of Armaments, to use colonial rubber to the best advantage.

1238 - **The Effect of Light in Healing Rubber-Tree Wounds.** — *India Rubber World*, Vol. LVII, No. 5, p. 310. New York, February, 1918.

Experiments on the effect of light on the healing of tapping wounds were recently made by HARMSEN on four year-old trees of equal dimensions. From each tree a strip of bark and cambium (from 1 to 5 cm.) was removed at a height of 1.5 metres and the wound covered with blue, green, yellow, orange and colourless glass. Blue and colourless glass gave the best results, yellow the worst. Uncovered wounds healed more slowly than those covered with coloured glass, which, in their turn, healed more slowly than those covered with colourless glass.

1239 - **New Varieties of Sugar Cane Produced at Porto Rico.** — COWGILL, H. B. (Experiment Station of Río Piedras), in the *Revista de Agricultura de Puerto Rico*, Vol. I, No. 3, pp. 114-118. San Juan, 1918.

At Java, in the British Antilles, Barbadoes and British Guiana, new varieties of sugar are produced each year in order to obtain a cheaper product capable of competing with beet sugar. At Porto-Rico it is also necessary to eliminate the poor and degenerate varieties. Seed is selected throughout the island. The Experiment Station of Río Piedras collected as many local varieties as possible and then crossed them. The hybrids were subjected to comparative tests first at the Station itself, then in other experimental centres and by growers. This work, though still in progress, has already given excellent results.

There are four prominent new varieties — B-3412, Sealy Seedling, D-117, B-376. The first gives a large yield, its juice is of average purity and sugar content, and it is specially suited to the hills of the southern coast of the island. The same may be said of the second. The third is better suited than the others to low land, in which it produces much thicker cane. So far the fourth has been tested only at the Río Piedras Station, where it has given excellent results. Other varieties worthy of mention are B-208 for cool, rich soil, in which it surpasses the others in sugar content, but is very subject to injury from drought, D-109, B-3405, etc.

Among the varieties to be eliminated are mentioned: — Otahitú or Caña blanca of the Río Piedras district, where it yields little and is subject to disease (it grows well in the rich fields of the south coast), dura roja or Cavengerie, Yellow Bamboo, Morada, and Pinang.

The work on disease-resistant sugar cane has not yet given absolutely

immune varieties. Those which have proved most promising in the comparative experiments are : — B-4596, B-3412, D-117, Caledonia Amarilla.

1240 — The Cultivation of Sugar-Cane in Persia. — CALDWELL, J. L., in *Commerce Reports*, No. 129, p. 858. Washington, D. C., June 3, 1918.

It is believed that the cultivation of sugar-cane was formerly more important in the Province of Mazanderan than at present, for it appears to have been abandoned on account of the difficulty in extracting the juice. Cane is cultivated at present around the edges of cotton fields, but it could doubtless be cultivated profitably on a large scale on suitable soil. The zone of cultivation is found in the rectangle formed by the Caspian Sea and a parallel line passing Amol, Barfaruche, and Sari.

Since the beginning of the war, the price of sugar having greatly advanced, the cultivation has again been taken up. It is estimated that the 1917 harvest totaled about 120 000 Tabrizi batmans (1 560 000 pounds), of which Mazanderan consumed about half ; 10 000 batmans were sent to Teheran and 50 000 batmans were transported in coasting ships to Enzeli, Chassovar, etc.

Two kinds of sugar-cane are grown in the Province : — a) The "Indi Lale" (the seeds of which are planted), which produces a sirup about the thickness of molasses of grapes, and b) "Sheker Lale" (of which the shoots are planted), yields a moist sugar which can be solidified.

Sugar-cane is planted in the spring and must be harvested in the autumn before it is cold enough for frost. The fields must be well tilled, and much moisture is necessary as in dry years good crops are not obtained.

When the crop has been cut it is stacked on the ground ; near by a hut is erected for cooking the juice. Four oxen are needed for crushing the cane. The juice is boiled during the night and about 50 mans (300 pounds) of dry reeds are used as fuel in one night. The process necessitates the presence of at least four persons. When done, the sugar is poured into moulds and removed as soon as it is cold. The production is about 1 600 pounds per acre.

Before the war 12 kharvars (8 000 pounds) of moist sugar cost about 100 toman (at normal rates of exchange 1 toman is slightly less than \$1) to produce and could be sold for about 120 toman. Therefore, with such small profits, peasants could plant only around the edges of fields or in small quantities. At present the cane can be cultivated in large quantities, for while the expenses of production amount to about 120 toman for 12 kharvars, that amount can now be sold for 240 toman or even more. Moist sugar is worth at least twice as much as the sirup from "Indi Lale".

1141 — Yellow Sugar Cane ("Mia-vang"), Red Cane ("Mia-ly") and Small Cane ("Mia-lau"), Varieties Grown in Indo-China. — See 1190 of this Review.

1142 — Future of the Yemen Coffee Trade. — In *The Board of Trade Journal*, Vol. 8, No. 1113, pp. 381-382 (380-382). London, 1918.

Coffee is the main product of Yemen agriculture and in 1909 there was a substantial increase in the value of this export as compared with the pre-

vious four years; but since the rain shortage throughout the Yemen highlands in the summer of 1920 there has been a great falling off in both quality and quantity, for many growers never emerged from the financial straits in which they were then involved. The following figures for 1909 show the normal movements of exported coffee:—

Markets.	Tons.	£.
French (chiefly Marseilles),	1 849	112 995
United States (New York and Boston)	836	51 000
Egypt	908	56 225
Aden (for reexport)	372	22 750
London	242	14 800

The various grades of Yemen coffee are named after the district of production. Harrazi coffee heads the market for quantity and general average of quality. The highest grades are Matari and Anisi, which are noted for the hardness and regularity of the beans; if stored too long at Hodeidah or elsewhere on the coast, where the air is invariably damp, the bean of both these grades is apt to whiten at the ends, which infallibly denotes deterioration to the practiced buyer; the Anisi bean is pale yellow, and very hard; it stores better than the Matari. The districts of Heimah and Reimah may be bracketed for yield and quality; the bean is somewhat irregular. Coffee from Mount Bura heads the lower grades, and is noted for the reddish tinge of the bean, which it loses if stored too long in the damp atmosphere of Hodeidah. The yield from J. Molhan is considered generally inferior to all other grades. The vague term Sherqi, or eastern, covers a large tract of country, and includes various grades; an average quality ranks in the market with the best from J. Reimah. Most of the Taizi coffee (S. Yemen) is imported via Aden. It should be noted also that the standard quality in the various districts may vary from year to year, owing to irregular harvesting, which is traceable to financial pressure on growers, or to political disturbances. Large tracts of coffee have been destroyed in disturbed areas.

1243 — **Tea in Indo-China.** — EBERHARDT, P., in the *Congrès d'Agriculture coloniale, Gouvernement Général de l'Indochine*, Hanoi Series, No. 9, 18 pp. + 1 Plate. Hanoi-Haiphong, 1918.

The species cultivated throughout Indo-China is the *Thea chinensis* Sims. (*T. sinensis* Linné), but there are many varieties. This may be explained by the variety of soils in which the crop is grown, as well as by differences in latitude and, consequently, weather conditions, which influence the development of the species (between 8° and 25° northern latitude.)

PIERRE describes five varieties of *Thea chinensis*. — *Bohea*, *viridis*, *pubescens*, *cantonensis* and *assamica*. The author (temporary Chief of the Economic Service of the General Government of Indo-China) believes there are

others, but this can only be decided by a close botanical study of cultivated and wild plants from the five parts of the Union. Samples should be collected all over Indo-China for this investigation, the result of which the author hopes to present to the Tea Congress to be held in Java in 1919.

NATIVE CULTIVATION. — The districts of Indo-China in which tea is most grown are, in order of importance, Tonkin, Annam and Cochinchina. Methods are very rudimentary everywhere. The greatest mistake the natives make is to plant tea in low land though the species prefers mountain districts. The slopes and table-lands of the Annam Chain, from north to south of the peninsula where the species grows wild, is admirably suited to this crop which would make all this mountain district more healthy.

The native's methods are the same everywhere. As he has not yet been persuaded to start nurseries he sows in the field, putting two or three seeds together in holes 23 to 32 inches apart. When germination is over only the strongest of the three plants is left, the other two being uprooted. Practically no care is given the plants, only weeding is practised and the great hardiness of the plant makes this sufficient. Neither pruning nor topping are carried out. Picking begins, as a rule, when the plant is three years old, and is generally so rough that the plant is entirely stripped of its leaves; this occurs several times a year.

The prices of the dried leaves vary so considerably that they cannot be attributed only to differences in the subsoil and must be due to different species or varieties.

EUROPEAN CULTIVATION. — Crops are so far only grown by Europeans to a small extent. There are barely 500 000 to 600 000 tea bushes in the European plantations of Tonkin and 200 000 in those of Annam. Every thing remains to be done and the Agricultural Services should appoint specialists capable of directing the development of European cultivation.

The native has not attempted to improve the cultivation of tea because, apart from the rich class who obtain their tea from China, the Annamite wishes to obtain qualities which to us are defects; he wants a very strong drink, his palate being burnt by lime and betel, and one which will enable him to shake off fatigue. Tannin, then, a glucoside, an essential oil, and an albuminoid (combined with the tannin), give the tea properties which are attenuated by industrial preparation and increase with the age of the leaf. The native picks the full-grown leaf and drinks an extract of green or simply dried tea.

PREPARATION. — There is only one establishment in Tonkin and two in Annam for preparing the leaves for export to France. The tea preparation industry has, therefore, yet to be created in Indo-China. This, however, can only be done when tea growing is definitely established on a rational basis and it has been possible to show the quality of Indo Chinese teas.

WILD TEA. — Apart from the formation of plantations attention should be given to the improvement of the wild species, abundant in the mountain chain which crosses the peninsula, with a view to the production of them.

The author reported for the first time in 1907 the existence of wild tea plants in the Tamdav Range, Tonkin. He has since found this plant in

different parts of Upper Tonkin and in the whole Annam Chain (North and Central Annam). According to recent information the tea drunk by the natives of Laos is obtained exclusively from wild plants, with the exception of the tea from China consumed by the rich classes. There appear to be two species of these plants:— 1) the "Mieng-luang", very common in the basins of the Nam-sang and Nam-bon (Muong of Vientiane), in the Tasseng of Natho (Vango-vieng), as well as in the Tourakhom district; it is a forest variety but has become acclimatised well on the banks of the Honei, 2) the "Mieng-noi" or "Mieng-kay", less common, and found almost exclusively in high districts and forests; it grows largely in the Muong of Vang-vieng and of Borikhane, but little in the Muong of Vientiane.

TEA TRADE.—The details of the Indo-Chinese tea imports and exports are given in table form. Annam is by far the largest exporter. In 1916 Indo-China exported 918 metric tons of tea, of which 888 went to France; 811 tons of this quantity were exported by Annam alone. In 1911 the exports were 559 metric tons (487 tons for Annam), of which 564 tons were sent to France. Indo-China imports tea from China (especially from Hong-Kong) and India. In 1915 the imports amounted to 970 metric tons, in 1916 to 903.

Analyses of different varieties of tea prepared by the native and by the French methods are given. The analyses were made by M. AUFRA Y, Director of the Agricultural Laboratory of the Institute of Hygiene and Bacteriology at Tonkin. The teas analysed were:—

1) Teas prepared by native methods:— tea from Trâu-ninh, mœc tea of 1st, 2nd, and 3rd quality, Chê-Lu, Tuyêt-lu, Man-thang, Vân-trân, Chê-tuoi, Chê-tuyêt, Chê-ta, Chê-bang, Bac-quang, Chê-tu, êt Ha-giang, Tuyêt-thai, Chê-thai.

2) Tea prepared by French methods:— Chaffanjon tea.

The analyses show Tonkin teas to be poorer in tannin and alkaloid than those of Annam, which are the richest in the world in their. They could, therefore, be grown advantageously (especially the wild species) for extracting this alkaloid. The analyses also show Tonkin teas to resemble Chinese teas in their tannin and alkaloid content. They, however, differ greatly in composition, so that they should not be prepared by the methods adopted in India and China. Great attention should be given to the chemical reactions so as to find the critical point which determines their quality, especially with respect to the fermentation.

It must not be forgotten that the commercial preparation of Indo-Chinese teas is closely connected with the existence of rationally conducted plantations. Great progress has already been made in this direction. The natives supplying European firms have been persuaded to bring young leaves which resemble much more those treated in Ceylon and China, instead of old ones.

The quality of Indo-Chinese teas has been tested by experts several times. M. C. A. GUIGNON and M. DIJANNET have shown certain commercial varieties of Annam tea to be excellent. It would be easy to aromatise the tea artificially as is done by the Chinese as all the floral species they

use for this purpose are found in the colony (*Jasminum Sambac*, *Olea fragrans*, *Aglaia odorata*, lotus pollen, etc.).

All efforts should be directed to the rational and commercial production of Indo-Chinese tea. Such an enterprise should capture rapidly the French market, which hardly exceeds 1500 metric tons, and compete easily with the Ceylon and China teas at present used :—

1) by supplying a superior quality, for the excessive tannin content of Ceylon tea absolutely ruins the intestinal mucosa and its astringency injures its flavour;

2) by producing qualities equal to the best Chinese teas, with the advantage of freedom from duties and less heavy freightage.

1244 - Vanilla as a New Product of Porto Rico. — McCLELLAND, T. B. (Assistant Horticulturist, Mayagüez Agricultural Station), in the *Revista de Agricultura de Puerto Rico*, Vol. I, Nos. 1-2, pp. 45-48. San Juan, April-May, 1918.

Although vanilla is exported in large quantities from Guadeloupe and Saint Domingo, islands near Porto Rico, it is hardly grown at all at Porto Rico itself. Nevertheless the existence in several localities (Bayamón, Dorado, Larcas, Maricao, Mayagüez, San Germán, Guánica, and Guayanilla) of wild vanilla probably belonging to species of no economic value, shows that vanilla should do very well in this country. The author made cultural experiments with vanilla at the Mayagüez Agricultural Station and obtained good results. The pods were judged excellent in appearance, scent and flavour and sold at \$ 5 per pound.

1245 - Saffron from Kosani, Greece. — VALDIGNÉ, in the *Journal de Pharmacie et de Chimie*, Series 7, Vol. XVIII, pp. 183-184. Paris, September 16, 1918.

Saffron grows wild in Asia Minor, Persia, and in Greece where it is cultivated most in the Kosani region, to the S. S. W. of Macedonia, on a vast plain, 2330 ft. high, and where the thermometer does not go below 5°C. The species, *Crocus sativus*, the same as that grown in France and Spain (1), is characterised by having deeply dentate stigmas; the plant barely reaches 8 in. in height and is propagated by bulbs; once planted it lasts 7 or 8 years. The flower only lasts one or two days; as soon as it appears the styles and stigmas are gathered by children and spread on carpets with a long pile where they lose $\frac{1}{4}$ of their weight. The reddish-yellow, more or less dark coloured stigmas are separated from the bright orange yellow styles; 100 lb. of crude saffron yields 60 lb. of red saffron and 40 lb. of yellow saffron; the latter, of no commercial value, serves for domestic purposes.

The red Kosani saffron is similar to the French Gatinais saffron; it has a strong pleasant smell and gives a fine dark-red powder; owing to its fineness it is very light. The price varies according to the supply and the quality; before the war it cost about 36s. a lb., the most esteemed being that with a light red brown colour. It is mostly sent to France where it is sold as Gatinais saffron.

(1) In Italy also, especially in the province of Aquila, which gives a good-quality product.
(Ed.)

1246 - **Govap Tobacco and Hocmon Tobacco, the Two Best Indo-Chinese Tobaccos for Native Consumption.** — See No. 1190 of this Review.

1247 - **Introduction of Cinchona into Madagascar.** — LEGENDRE, J. In the *Bulletin du Muséum national d'Histoire naturelle*, Year 1916, No. 7. Paris.

The Colonisation Service planted cinchonas from seed from the Dutch Indies. Certain high districts of Madagascar appear suitable to cinchona growing which, if successful, might prove a source of income for the colony.

1248 - **Some Useful Plants of Chili (i).** — COSTES, in the *Bulletin de la Société nationale d'Acclimation*, Year LXXV, No. 4, pp. 112-115. Paris, April, 1918.

A list is given of the following useful plants of Chili:—

"Algarrobo" (*Prosopis Siliquastrum* Gay = *P. juliflora* D. C.). — A tree about 20 to 25 ft. high, growing from Coquimbo to the Cachapoal river. The pods are much liked by animals. The wood is a violet-brown, very hard and used by wheelwrights; it gives very good charcoal. The seed is much appreciated medicinally for cardiac troubles on account of the tannin it contains.

"Molle" (*Lithraea molle* Gay = *Schinus latifolius* Engl.). — A bushy tree about 16 ft. high. Before the vine was introduced a fermented drink "chicha de molle", was made from its fruit. The white resin, obtained by making incisions in the trunk, is much used for curing leucoma and for making poultices for blows, sprains, and muscular rheumatism. The bark extract is used for nervous diseases. Wood used by wheelwrights.

"Guayacan" (*Portieria hyzometrica* Pav. = *P. hyzometra* R. and Pay.) — A bush growing in sandy soil or alluvion. The light yellow, very hard wood is used for making small articles (combs, spoons, knife handles, bearings, etc.). The wood contains much resin which is used as an emmenagogue, stimulant, diaphoretic, and balsamic. It is recommended for herpetic troubles, chronic rheumatism, chest troubles, and as a cure for blows, bruises, and syphilitic troubles.

"Alcaparra" (*Cassia vernicosa* Clos = *C. laevigata* Willd.). — A bush common in the central provinces. The wood is very hard, resistant, and almost immune to the effects of damp and, therefore, used as props for vines. The bark and fruit are used as astringents. The leaves are purgative and the extract made from them is used to cleanse the head and free it from parasites.

"Litre". — An evergreen bush from 16 to 20 ft. high. In the rocky mountains or those with loamy soil it is stunted and the stem grows parallel with the soil. The wood is used by wheelwrights, is very hard, and makes excellent charcoal. The "litre" is recognised as dangerous as in some people the shade, smoke, wet leaves and sap cause swellings which become pustules. Dr. A. MURILLO believes the extract could be used like thapsia to resolve eruptions; resin and volatile oil.

(i) See R., May, 1916, No. 498. (Ed.)

1249 — **The Pollination of Fruit in Relation to Commercial Fruit Growing** (1). —

HOOPER, C. H., in *The British Bee Journal*, Vol. XLVI, No. 1463, pp. 13-14; No. 1465, pp. 28-29; No. 1467, p. 45; No. 1470, p. 73; No. 1471, pp. 79-80; No. 1473, pp. 97-98. London, 1918.

The author gives the results of his investigations and experiments on the pollination of fruit trees, including apples, pears, plums, and cherries. Lists of the fertile, and self-sterile varieties of each of these fruits are given, as well as lists of the different varieties which should be planted together. Most of the cross-pollination, specially in the case of apples, is done by insects, particularly hive and humblebees.

APPLES. — Fertile: — Irish Peach, Golden Spire, Stirling Castle, White Transparent (occasionally), Lord Derby, Tower of Glamis, Duchess of Oldenburgh, Egremont Russet, Devonshire Quarrendon, Summer Golden Pippin, Christmas Pearmain, Dominé, Washington, Ben's Red, Red Reinette, Lord Grosvenor, Early Victoria, Ecklinville, Allington, King of the Pippins, Peasgood's Nonsuch, Pott's Seedling, Gladstone, Newton Wonder.

Self-sterile: — Astrachan, Ribston Pippin, Lord Suffield, Hoary Morning, Warner's King, Nonpareil, Striped Beefing, Sturmer Pippin, Fearn's Pippin, Belle de Pontoise, Duchess's Favourite, Bismarck, Cox's Orange, Beauty of Bath, Hambling's Seedling, King of Tompkin's, Beauty of Kent, Cellini, Worcester Pearmain, Scaton House, The Queen, Rival, Alfriston, Lady Sudeley, Loddington, Blenheim Orange, Waltham Abbey, Prince Albert, Grenadier, Hollandbury, Lady Henneker, Cox's Pomona, Golden Noble, Annie Elizabeth, William's Favourite, Mère de Munage, Sandringham, Graham's Royal Jubilee.

Varieties to plant together: — Bismarck with Barnack's Beauty and Lord Derby; Warner's King and Cox's Orange; Cox's Orange Pippin with Worcester Pearmain, Duchess's Favourite, King of the Pippins and James Grieve; Beauty of Bath with Allington Pippin, Lane's Prince Albert, and Gladstone (but Gladstone does not crop well with Beauty of Bath); Bramley's Seedling with almost any variety, especially Cox's Orange, Lane's Prince Albert, Newton Wonder, and Grenadier; Lady Sudeley with Gladstone; James Grieve with Cox's Orange, Stirling Castle, King of the Pippins, and Blenheim Orange; Gladstone with Cox's Orange and Worcester Pearmain; Peasgood's Nonsuch with Wellington; Grenadier with Lane's Prince Albert and Early Victoria; Lord Derby, to some extent self-fertile, but improved by cross pollination, crops well with Graham's Royal Jubilee or Beauty of Bath; Lane's Prince Albert with Lord Derby, Stirling Castle, Grenadier, Beauty of Bath, Cox's Pomona, Bramley's Seedling and Allington Pippin; Annie Elizabeth with Warner's King; Newton Wonder with Prince Albert and Lord Derby; Worcester Pearmain with James Grieve; St. Edmund's Pippin with Ribston; Allington with Worcester Pearmain; Cox's Orange with Sturmer Pippin and Lord Grosvenor.

(1) See also *B.*, Jan., 1912, No. 83; *R.*, Febr., 1914, No. 133; *R.* Jan., 1916, No. 62; *R.*, June, 1917, No. 554; *R.*, June, 1918, No. 649. (*Ed.*)

PEARS. — *Slightly self-fertile*: — (In England) Conference, Durondeau, Duchesse d'Angoulême, Colmar d'Été, Hacon's Incôparable, Marguerite Marillat; (in America) Duchesse d'Angoulême, Beurré Bosc, Beurré Diel, Doyenné d'Alençon, Flemish Beauty, White Doyenné.

Self-sterile: — Beurré d'Amanlis, Beurré Superfin, Catillac, Emile d'Heyst, Jargonelle, Josephine de Malines, Louise Bonne of Jersey, Beurré Alexandre Lucas; Clapp's Favourite, Williams' Bon Chrétien, Olivier de Serres, Bellissime d'Hiver, Pitmaston Duchess, General Todleben, Winter Crisanne, Marie Louise, Dr. Jules Guyot, Beurré Diel, Citron des Carmes, Wydale's St. Germain, St. Luke, Souvenir du Congrès.

Varieties to plant together: — Dr. Jules Guyot with Doyenné du Comice and Williams' Bon Chrétien; Williams' Bon Chrétien with Le Lectiel, Winter Crisanne and Fertility in England, with Beurré d'Anjou and White Doyenné in U. S. A., with Bailey's Bergamot in Victoria, Australia; Pitmaston Duchess with Catillac, William's Bon Chrétien, and Louise Bonne of Jersey; Doyenné du Comice crops fairly well with Pitmaston Duchess, Conference and Fertility and well with Emile d'Heyst, Souvenir du Congrès and Glou Merceau; Clapp's Favourite with Josephine de Malines; it also fruits well among a mixture of pears.

PLUMS. — *Self-fertile*: — Victoria and Czar fruit nearly as well self-pollinated as cross-pollinated; Denniston's Superb, Monarch (but should not be planted alone), Early Favourite, Reine Claude Violette, Myrobellia, Giant Prune, Early Transparent, Reine Claude de Bavay, Prince Englebert, Early Favourite, Gisborne, Oullin's Golden Cage, Golden Transparent, Pershore, Magnum Bonum (red and white), Kentish Bush, Warwickshire Droopers, Damsons.

Nearly self-sterile. — Rivers' Early Prolific, Mallard, Stint.

Self-sterile: — Histon Gage, Early Orleans, Sultan, Kirke's Blue, Coe's Golden Drop, Coe's Violet, Washington, Late Transparent, Ickworth Imperatrice, Early Greengage, Old Greengage, Reine Claude d'Altham, Wydale, Grand Duke, Jefferson, Pond's Seedling, Curlew, Prune d'Agen, Bryanstone.

Varieties to plant together: — Coe's Golden Drop with Pond's Seedling, Early Rivers, Reine Claude Violette, Rivers' Early Prolific, Prune d'Agen, Monarch, Wydale, Denniston's Superb, Early Mirabella and Reine Claude d'Altham, does best near several varieties of plums; Early Greengage and Old Greengage do not inter-pollinate but set well with pollen of Victoria and Pond's Seedling; Wydale with Rivers' Early Greengage and Coe's Golden Drop; July Greengage with Old Greengage and Rivers' Early Prolific; Greengage with Egg plums, Early Orleans, Monarch, Pond's Seedling, Kentish Bush, Victoria, Czar, Rivers' Early Prolific; Rivers' Early Prolific with Egg plums, Early Orleans, Czar, Monarch, Prince of Wales, Pond's Seedling; Belle de Louvain with Prince of Wales, Duke, Victoria, Czar, Egg and Early Rivers; Pond's Seedling with Pershore plums and damsons; Washington with Pond's Seedling, Early Transparent with Late Transparent and *vice versa*; Reine Claude d'Altham with Coe's Violet, Coe's Golden Drop and Jefferson; Monarch with Rivers' Early Prolific.

CHERRIES. — *Self-fertile*: — Morello, Kentish Wye Morello and Late Duke.

Self-sterile: — Black Heart, Elton, White Heart, Kentish Early Rivers, Burg d'Aunay, Black Tartarian, Bigarreau Napoleon, Bigarreau Frogmore, Early Giugne d'Annonay, May Duke.

Varieties to plant together: — Elton with Early Frogmore; Black Heart with Morello; Early Rivers Black with Baumann's May, Goodenston Black, Turk, Elton, Knight's Black, Governor Wood, Coronne, Florence, Black Heart, Waterloo, Black Eagle, Amber Bigarreau, Old Kentish Black and Circassian; Elton Heart with Early Rivers, Montreuse de Mezel and Frogmore; Black Tartarian or Turk with Black Eagle, Napoleon, Elton, Amber Bigarreau, Knight's Early Black and Early Rivers; Kentish or Amber Bigarreau with Black Eagle, Turk, Elton, Frogmore, Waterloo, and Governor Wood; Waterloo Black with Circassian and Amber Bigarreau; Napoleon with May Duke, Webb's Black, Governor Wood, Waterloo, Amber Bigarreau, Morello and Frogmore, in California it does well with Black Tartarian, Black Bigarreau and Bing, and in Oregon with Deacon and Lambert; Governor Wood with Elton and Napoleon; Old Kentish Black may be self-fertile but fruits well with Elton, Early Rivers, and Turk; Black Eagle with Turk; Knight's Early Black with Black Eagle; Circassian with Old Kentish Black and Early Rivers; Florence with Napoleon and Early Rivers; Roundel with Amber Bigarreau.

GOOSEBERRIES, CURRANTS, RASPBERRIES, LOGANBERRIES, AND STRAWBERRIES. — In England all these set and mature fruit perfectly with pollen of the same plant or variety, though some of the strawberries grown in Canada and the United States need to be interplanted with another variety for cross pollination. Insects are absolutely necessary to pollinate gooseberries and white, red, and black currants. Raspberries and loganberries give only imperfect fruit if not pollinated by insects, and strawberries, though chiefly pollinated by the movement of the air, doubtless benefit by insect pollination.

1250— **Direct Bearers at the National School of Agriculture of Montpellier (Hérault France).** — RAVAZ, L., in *Le Progrès agricole et viticole*, Year XXXV, No. 12, pp. 265-272. Montpellier, March 24, 1918.

In the School experiment field, in order to estimate with exactitude the value of each direct bearer, side by side with the new ones were placed old ones, such as Delaware, Othello, Autrichon, Canada, Secretary, Jacquez, Noah, Elvira, York-Madeira, Clinton, Herbecmont, Telegraph.

OLD HYBRIDS. — *Delaware*. — This plant showed little resistance to mildew. Its foliage is very similar to that of *V. aestivalis*, from which it descends. The fruit is very ripe with a very pleasant flavour and would make excellent liquor. Unfortunately the smallness of the bunches excludes a high yield, nevertheless its cultivation might be attempted in districts where liqueurs are produced. It must be grafted as it is almost completely unresistant to phylloxera.

Othello. — Does less well than in the centre of France. Its resistance

to mildew is unsatisfactory but sufficient for the usual treatments to protect it.

Secretary. — No resistance to mildew.

Jacquez. — This was, as usual, much affected by mildew. Grafted on *Rupestris* it is exceedingly weak, but stronger ungrafted. It does not combine well with other stock, especially *V. rupestris* (suffers from thyllosis). As it is fairly resistant to phylloxera it must be planted ungrafted if the soil is of sufficiently good quality. Some of its varieties are better grafted:— *Jacquez-Marignan* (always very fine on *Rupestris*) and *Jacquez-Dauty*.

Noah. — Not immune to mildew, but sufficiently so and, in practice, may be grown without treatment; only in wet springs is it advisable to spray the bunches. Ungrafted it is rather weak at the School as it is subject to chlorosis and the soil is very calcareous.

Clinton (Plant Pouzain or Plant des Carmes). — Resistance to mildew equal to that of *Noah* and may also do without treatment. It is less fine ungrafted than grafted and suffers especially from phylloxera.

Elvira. — Same remarks.

Herbemont. — More resistant to mildew than *Jacquez* and is easily protected by a few sprayings. Grafted on *Rupestris* it dies (effect of thyllosis). Ungrafted it suffers much from chlorosis. Is particularly affected by lime, but in clays or sandy loams containing little or no lime it grows wonderfully and resists phylloxera for a fairly long time. Wine excellent.

NEW HYBRIDS. — 71-61 C. — Brother of 71-10 and fairly resistant to mildew and, to a certain extent, to phylloxera; it might be grown in soils little subject to phylloxera, or cool and deep. It is less fine grafted on *Rupestris* than ungrafted (thyllosis).

71-06 C. — Very high resistance to mildew, superior even to that of *Noah*.

71-20 — One of the best of the Bayard direct bearers. Its foliage is very healthy, so is its fruit except in cases of very violent and very early attacks of mildew. It gives a large yield, ripening at the same time as *Cagnan* and *Mourvèdre* and is, therefore, suited to the western districts of France in the soils previously occupied by *Mourvèdre*. Wine without any special taste or smell, very good to drink alone and for making good brandy. For this purpose it could be of value in *Armagnac* and *Charentes*. It can be grown ungrafted in soils little subject to phylloxera and containing little lime, or cool and deep. Does well on *Rupestris*.

1 *Seibel.* — High resistance to mildew. Very fertile though not very regular. Is not resistant to phylloxera but does well on *Rupestris*. It needs at least one early treatment and one at flowering time. The wine has a slight flavour of *Linccumii*.

29 S. — Has too strong a musty taste; bears very well.

1020 S. — Does not appear to deserve all the good said of it; suffers from mildew, phylloxera and grafting.

128 S. — Early; does very well when grafted, but insufficiently resistant to phylloxera and must be treated several times with sulphate.

142 *E. M.* — A hybrid, $\frac{1}{2}$ *Vinifera* and *Riparia*, obtained at the School. Its yield is small, but it is remarkably resistant to mildew.

4401. *Condorc.* — Always proves resistant to disease but its yield is irregular. It may be grown ungrafted in cool or deep soils little subject to phylloxera. Grafted on *Rupestris* it is very vigorous, even too much so, and would probably be better grafted on *Riparia*.

Jouffreau. — Is only an *Auxerrois-Rupestris* = *Pardes*.

28-112 *Condorc.* — Produces little and is affected by sulphur or scorching; does not do well grafted; very resistant to mildew.

580 *Jurie.* — Very resistant to mildew and almost sufficiently so to phylloxera in soils little subject to the disease. Bears well in favourable weather, sometimes non-sets. Does not require treatment.

132-11 *Condorc.* — Always fairly immune to mildew. This is one of the few hybrids which do not require sulphate spraying except under extremely unfavourable conditions. Does well ungrafted.

60 *S.* — Fine bunches; sufficiently resistant to mildew and phylloxera.

138 *S.* — Always covered with grapes which often weaken it considerably and ripen irregularly.

1025 *S.* — Valuable; fairly resistant to mildew and phylloxera. Bears well. Wine of good quality.

2007 *S.* — Appearance and almost the yield of *Aramon*. A fine neutral wine; no special flavour or smell. Hardly resists anything and does not ripen its wood in France.

9 *S.* — Very resistant to mildew but not very vigorous.

36 *S.* — Very resistant to mildew and perhaps to phylloxera as well with an almost satisfactory yield. The wine is strongly coloured and, unfortunately, has a *Rupestris* flavour.

880 *S.* — A white hybrid very valuable on account of its high resistance to mildew but which does not appear to resist phylloxera. The clusters strongly resemble those of the French vine. Fruit of no special flavour or smell and even pleasant, subject to grey rot as soon as ripe, which is both a defect and an advantage. A plant which should be kept in sight. Does very well grafted.

1000 *Seibel.* — Very resistant to mildew and perhaps sufficiently so to phylloxera in soils which are little subject to phylloxera or in vegetable mould. Ripens early with a production satisfactory for central France. Wine of a good colour, not too thick and may be drunk unadulterated. Would probably prove of value in the Rhône and Saône-et-Loire. It is subject to anthracosis, but may be protected by washing with iron sulphate.

6239 *Castel* and 129-4 *Malègue.* — Their merits have yet to be confirmed.

157 *Gaillard.* — A heavy bearer. It is little subject to mildew though it is well to spray it once or twice with sulphate. Does not resist phylloxera. It is rather weak and should be grafted on strong stock, well cultivated and manured as its fertility has a tendency to decrease. There are

sometimes spots of scorching on the leaves, especially when grafted, but they are of no importance. Large fruit with rather a marked but agreeable flavour which recturs in the wine.

22 *Baco*. = *Maurice Baco*. — A heavy bearer, 3 or 4 clusters per branch. Foliage similar to that of *V. Labruna*, not immune to mildew though resistant to a certain extent. Grapes resembling those of *Folle*, a little acid, but neutral. Wine neutral, quite like that of *Vinifera*. Should make good brandy. Does very well on a vigorous stock.

Oiseau-Bleu = 503 *Couderc*. — Very resistant to mildew and even to phylloxera in certain soils. Yield rather small but satisfactory where the vine is grown as an accessory. It is spreading largely on the slopes of the Ardèche because of its erect bearing and other characters. It is a vine for the farmer or metayer.

24-23 *Baco*. — Very resistant to mildew but yields very little.

The substitution of direct bearers for French vines is justified neither by the abundance nor the quality of the produce as the ordinary varieties can give more abundant and better produce than the hybrids. Nor is it always justified by a satisfactory resistance to phylloxera to assure sufficiently long duration. Only a few of the hybrids can be grown ungrafted in all soils if there is not too much lime.

In a rainy climate or cool soil, little subject to phylloxera, and in sandy and sandy-loam soils, in deep and rich land which allows the plant to heal rapidly wounds caused by insects, many of these new vines can be grown ungrafted. The lands of the South West, where the French vine held for a long time, or is still holding, without treatment, are the most favourable for direct bearers with good, or even medium, resistance to phylloxera. In a warm and dry climate direct bearers, barring the exceptions already mentioned, should be grafted on strong, vigorous stock; *Rupestris*, 1202, 93-5, 3300, 3306, etc. Only hybrids with exuberant vegetation or a tendency to non-set should be placed on *Riparia* or similar plants.

The use of these vines is justified by their resistance to disease, especially mildew. The characters of each of them from this point of view is now known. They should, therefore, be grown :—

- 1) in rainy districts, where diseases are severe : east, centre, north, west, south-west, and mountainous districts ;
- 2) everywhere where the vine is cultivated as an accessory and can not be given the requisite care ;
- 3) not even the best of them are suited to the production of the best wines, but in large vineyards a small place might be set apart for them for the production of wine for the workers.

In less hot and dry climates their use, for the moment at least, is very restricted, but they might be used either grafted or ungrafted, according to the soil, wherever mildew is particularly difficult to control—land frequently flooded or holding rain for a long time in hollows round the roots of plants, spongy lands impracticable for a long time after rain, where treatment is nearly always badly carried out and where mildew usually occurs every year.

4) all vines might be re-grafted using direct bearers as scions, not to avoid subsequent treatments, which would be useless, but to assure the taking of the stock in the ground. These, like French vines, are frequently destroyed by mildew in unfavourable years; it is clear that hybrid grafts would resist much better.

There are other, more recent, hybrids, of greater promise than those studied. M. COUDERC especially has some of which great hopes are entertained. The same may be said of some of those of M. BERTILLE-SEYVE, etc.

1251 — The Effect of Pruning on Grafted Vines (1). — LEBRUN, L., in *Le Progrès agricole et viticole*, Year XXXV, No. 29, pp. 61-65. Montpellier, July 21, 1918.

The author (Director of the Agricultural Service of the Marne Department) gives the results and conclusions he obtained from a series of investigations in the experimental vineyard of the departmental laboratory of Châlons-sur-Marne, France, where care of the vines has been irregular since the beginning of the war.

The experimental plot, along a wall on a hillside, is exposed to the south and contains 38 to 45 % of lime very apt to cause chlorosis. The vines are Vert doré and Chardonnay grafted on 1202 and 41 B (Vert doré on 1202 is distinctly inadvisable). The method of pruning has a marked influence on the longevity of the vine and preference should be given to that in which the stock develops most. This effect is clear if it be admitted that the reserves accumulate in the old wood in larger quantities when it is of greater volume. Unfavourable years distinguished by serious attacks of mildew, lack of fertiliser and attention may follow each other with no result other than a more or less marked decrease in vegetation. This, however, is not the case when the stock is reduced, as in the Guyot pruning method, as it is much more sensitive and may disappear if neglected for one or two years. The question arises whether large trellis-work does not contribute efficiently to the resistance of the plants to phylloxera and does not suffice to explain their relative immunity.

1252 — The Bark of Scotch Pine and Spruce. — WRETIND, J. E., in *Skögsvårdsföreningens Tidskrift*, Year XV, No. 1, pp. 22-60 + 14 Figs. Stockholm, 1917.

This paper gives the results of a thorough study of the thickness of the bark of Scotch pine and of spruce made in forests in central Sweden.

The following conclusions were drawn from the many numerical data collected: — 1) the thickness of the bark of Scotch pine at breast height is in constant ratio with the diameter of the trunk, whatever the age of the plant; in the spruce, on the other hand, the ratio of the bark to the diameter decreases when the diameter is larger; 2) the bark of the spruce decreases appreciably in thickness during drying; thus, for example, the bark of a forty year old spruce with a diameter of 22.7 cm. at breast height, dried at the temperature of an enclosed space,

(1) See R. May, 1917, No. 432. (Ed.)

decreased in thickness in 48 hours, passing from 4.4 mm. to 2.7 mm.; the decrease in the whole diameter, including the bark, was, in the same length of time, from 22.70 cm. to 22.55 cm.; apart from its commercial importance this fact calls for further investigation; 3) in the spruce, the bark is usually thicker at the base than at breast height; it decreases in thickness up to 20 or 30 % of the height of the tree, and again thickens towards the top. None of these differences are very marked, and are such that, in practice, the percentage of bark at breast height may be applied to the whole trunk.

The author recommends that, when standing wood is sold, the measurement be taken under rather than outside the bark, and that the thickness of the bark should be determined for each station. He also proposes a formula to calculate its percentage of the cubic mass.

LIVE STOCK AND BREEDING.

1253 - **Stock-poisoning Plants of the Range, in the U. S. A.**—MARSH, C. D., in the U. S. Department of Agriculture, *Bulletin No. 573*, pp. 1-24 + 30 Plates. Washington, July 23, 1918.

Very heavy losses in live stock are caused by poisonous plants. The exact extent of these losses is not known, but, in some States, it is estimated to be as much as 3 to 5 %, and in others is still higher. In Colorado such losses amount to a million dollars annually, while the annual loss of sheep in Wyoming is placed at 14.6 %. As the animals which die are mostly adult ones, ready or nearly ready for market, the loss is all the more severe. For some years past the U. S. Department of Agriculture has been making experiments with poisonous plants. Such experiments are especially difficult because many of the plants toxic to animals only cause illness when eaten in considerable quantities. The aim of the bulletin under review is to give a short description of the more important plants poisonous to stock, so that they may be easily recognised by non-technical people. The effects produced by the plant are also described as well as the time when losses usually occur together with the means of avoiding them. Special attention is drawn to the fact that most poisonous plants, with the exception of the loco (1) group, are distasteful to stock, who only eat them when there is a lack of other food. Poisoning frequently occurs when sheep are kept too long on the same bedding ground; during the first few days they eat all the available plants along the road they pass going backwards and forwards on each day, with the result that they are almost sure to consume poisonous plants later on. As far as possible sheep should be left to graze under natural conditions, that is to say, they should be able to go freely and slowly, separated from each other, and not allowed to graze over and over upon the same ground.

The plants discussed in the bulletin include:—

(1) The word "loco" is from the Spanish and means mad.

THE LOCO PLANTS (1), the most destructive of all poisonous plants. The group includes white loco, or rattle weed (*Oxytropis Lambertii*); purple loco, woolly loco, or Texas loco (*Astragalus mollissimus*); *Astragalus diphysus*. **LARKSPURS (2)**: — *Delphinium cucullatum*, *D. Barbeyi*, *D. Menziesii*, *D. bicolor*, *D. virescens* (= *azureum*). **WATER HEMLOCK (Cicuta) (3)**. **DEATH CAMAS (3)**, *Zygadenus venenosus*, *Z. elegans*, *Z. paniculatus*. **LUPINE**, also known as blue pea and wild bean. **LAUREL**, *Menziesia glabella*, black laurel (*Leucothoe Davisiae*), *Ledum glandulosum*, white laurel (*Arzalea occidentalis*), *Rhododendron albiflorum*. **COMMON BRACKEN FERN (Pteris aquilina)**. **WILD CHERRY**. **MILKWEED (Asclepias)**. **WOODY ASTER (Xylorhiza Parryi)**. **COLORADO RUBBER PLANT**, or pingue (*Hymenoxys floribunda*). **WESTERN SNEEZEWEED**, or yellow weed (*Dugaldia Hoopestii*), *Psoralea tenuifolia*.

1254 — The "Enfermedad de los Rastrojos" or "Locura de los Caballos" in the Maize Growing Regions of the Argentine; Means of Control. — *El Campo*, Year II, No. 11, p. 350. Buenos Aires, 1918.

In the maize-growing regions of the Argentine and particularly in the province of Santa-Fé, a non-contagious disease of the horse appears from time to time, as in 1911 and 1918. The disease affects farm horses fed on more or less mouldy maize (whole plant or grain), or put to pasture on maize stubble. The disease is called "enfermedad de los rastrojos" (stubble disease) or "locura de los caballos" (horse madness). The mortality may attain 50 % of the farmer's stock, but decreases when the soil is begun to be cultivated for the new crop.

In some cases the disease has a very rapid course. Generally, however, it shows the following symptoms:—blindness or squinting, trembling, constipation, great excitement. In other cases it is shown by great depression and by paralysis of various parts of the body. At the post mortem examination the brain is found to be extremely softened in one or both hemispheres (usually the left).

The experts of the Veterinary Department ("Dirección general de Ganadería") of the Argentine Ministry of Agriculture, who have studied the disease very thoroughly, recommend the following treatment:—

1) If the horses are at pasture in maize fields where only the stubble remains, they must be removed at once and kept in enclosures where maize is not grown.

2) As soon as the first symptoms of the disease are seen, a hypodermic injection of pilocarpine hydrochlorate (0.2 gm.) + eserine sulphate (0.05 gm.) + distilled water (10 gm.) should be given in the neck.

3) Sometimes horses thus injected are very depressed; to stimulate them an injection must be given (and repeated 2 or 3 times a day, if necessary) composed of caffeine (1 gm.) + sodium benzoate (2 gm.) + distilled water (5 gm.).

(1) See also *R. Dec.*, 1915, No. 1309. — (2) See also *R. Dec.*, 1915, No. 1309 and *R. Jan.*, 1918, No. 55 — (3) See also *R. Oct.*, 1914, No. 016, and *R. Dec.*, 1915, No. 1309. (*Ed.*)

4) During the 2 or 3 days after treatment each animal must be given 2 tablespoonfulls of creoline mixed with a litre of water.

1255 - On the Isoanaphylatic Poisoning Due to Certain Immunising Serums. — CARPANO, M., in *La Clinica veterinaria*, Year XI, I, No. 70, pp. 261-274. Milan, May, 1918.

The author describes the observations he has made at the "Istitute Siero - Vaccinogeno Eritreo" and at the Bacteriological Laboratory of the Army Veterinary Service at Rome, on the special hypersensitivity shown by certain sick animals as regards respective and homologous immunising serums. These observations are not only of interest for the scientific study of the phenomena of immunity but also for the practical application of ordinary serotherapeutic treatment. They deal directly with streptococcal infections, cattle plague and horse sickness.

The *toxic property* of certain serums, even when normal, injected into animal species other than those from which they have been obtained, has long been known. It was thought that the toxic phenomena should be exclusively attributed to the different origin of the albumins, but it has lately been found that the phenomena may also occur, but less frequently, when albumins coming from the same species and even the animal treated are used, *i. e.*, using *isoalbumins* and *auto-albumins* respectively (PICH and YAMONOUCHI, 1908; ACHARD and TOURAINE, 1912; WIDAL, ABRAMI and BRUSSAUD, 1912; PETRI, 1913; MIRICAPILLO, 1913; MELLO, 1913; NETTER, 1915; NETTER, KOEHLIN and SALAMIER, 1916; MARIE, 1916; FINZI, 1916). The author has observed similar phenomena in the following cases:—

1) A horse that had been inoculated with a culture of streptococci and, 5 days later, with polyvalent antistreptococcal serum, showed phenomena similar to those usually occurring with anaphylactic disturbances. But in this case there was no true anaphylaxia, on account of the absence of the chief factors on which the classic form of the phenomenon is based, *i. e.*:—
a) heterogeneous serum; b) the existence of a preceding action leading to the phenomenon. In addition, the phenomenon of antianaphylaxia or de-anaphylaxia, which renders the organism insensitive after a first anaphylactic crisis, did not show itself.

2) In cattle injected in the jugular with 80-100 cc. of homologous anti-plague serum, the author has frequently found that the grave poisonings often followed by sudden death were not due to the phenol contained in the serum (cattle tolerate up to 2 gm. injected intravenously with impunity), nor to the traumatic action of the albumin flakes suspended in the serum, nor to air bubbles introduced into the veins. As a result of this the author abolished the intravenous method and has limited the treatment of cattle plague solely to subcutaneous serotherapy which, when given when the disease first shows itself, gives a high percentage of recoveries.

3) In horses suffering from horse-sickness and treated with a homologous serum, particularly when injected directly into the jugular. This serum has a powerful haemolytic action. THEILER made similar observations in 1904, during his researches on immunisation against horse-sickness in South Africa.

Given that, in all the previous cases, a homologous serum (*i. e.*, obtained from the same species of animal) was used, it must be admitted, contrary to the still current opinion, that the serum of certain organisms, whether specially treated or not, can possess the properties of antigens towards organisms belonging to the same species in other words an *individual specificity*, whether acquired or natural, must be admitted. Those cases of hypersensibility observed in some of the animals treated are much more pronounced and frequent when the serums used are obtained from material hyperimmunised with animal products (virulent blood), as is the case with cattle plague and horse-sickness, than when they are obtained, on the contrary, from animals hyperimmunised with bacterial material, as is the case in streptococcal infection. The author gives this hypersensibility the name of "*toxicose anafilatoïde*" (anaphylactoid poisoning), thus indicating those reactions that are special to the organism, similar to the anaphylactic manifestations that occur in the organism itself as the result of the introduction of normal or immunised homologous serums, without there being a previous sensibilisation (1).

The author discusses some of the hypotheses put forward to explain the origin of the phenomena in question: — above all, individual predisposition; presence of incompletely neutralised antigens in the serums; eventual reaction between the antigens contained in the sick organism and the antibodies introduced with the immuniser; presence of isoagglutinins, isoprecipitins and isolysins in the immuniser; complex modifications of a biophysical-chemical nature undergone by the serums during their preparation, and which would give them antigenic or completely toxic properties.

PRACTICAL CONCLUSIONS. — In some infections, a certain number of sick individuals (consisting of predisposed subjects) can show a particular hypersensibility as regards homologous preventive immunisers, especially when they are introduced directly and in considerable quantities into the circulation; this is why intravenous serotherapy when it is the case of certain serums and in spite of their efficacy, is not free from disadvantages which, from simple, passing disturbances, may develop to the most alarming morbid symptoms and even cause the death of the subject.

1256 — **The Anaphylactic Nature of Parasitic Poisoning.** — VAN ES, L. and SCHALCK, A. F. (Veterinary Department of the North Dakota Agricultural Station), in the *Annales de l'Institut Pasteur*, Year XXXII, No. 7, pp. 310-362 + 5 Tables + 5 Figs. + Bibliography of 20 Publications. Paris, 1918.

The part played by the filtrable, ultra-microscopic virus of VALLÉE and CARRÉ in infectious anaemia of the horse has been confirmed by many researches. Again, the recent explanations of the etiology of the disease proposed by MM. SEYDERHEIM (Strasbourg) during their researches on the pathological nature and treatment of infectious anaemia of the horse have

(1) BEHRING calls *anaphylactoid substances* those that reproduce the syndrome of anaphylaxis without there being a previous preparatory action. See PESCI, *Forme anafilattiche*, Turin, 1916. (Author)

greatly interested other workers. The results arrived at by the authors are given below.

Anaemia of the horse can be produced artificially, down to every detail, by injecting aqueous extracts of *Gastrophilus equi* and *G. haemorrhoidalis* (*Oestrus*).

Judging from its action and its behaviour as regards physical and chemical influences, the active constituent is an animal poison, called *oestrine* by the authors.

The toxic action of oestrine, exclusively specific for the horse (and ass), is reabsorbed by the gastro-intestinal canal; it occurs in the excreta of the larvae of *Gastrophilus* and that of the species *haemorrhoidalis* is much more toxic than that of the species *equi*.

Pernicious anaemia produced artificially in this way can be transmitted to healthy horses by means of the blood, and by the blood of the latter to other horses; in nature pernicious anaemia is not produced by an ultra-visible virus, but by oestrine alone.

The authors have checked their theory by a number of experiments:—

1) Study of the results produced by injecting the horse with extracts of the larvae of *Gastrophilus* (intravenous and subcutaneous injections; action of dialysis, alcoholic and acetone extracts and heat on the poison of *Oestrus*); 2) study of oestrine as regards its importance in the pathogenesis of the disease and on the eventually anaphylactic character of the reaction produced by the injections. In this way the authors have been able to formulate the following theory:—

There is no reason to believe that the species of *Gastrophilus* play a *specific part* in the etiology of pernicious anaemia of the horse; the severe poisoning following the injection of gastrophilic matter observed by MM. SEYDERHEIM and also by the authors, is not caused by a specific substance such as oestrine; it is simply the *manifestation of anaphylaxia* and is quite analogous to that produced by proteins. Many parasites sensitise their hosts which, after injection or instillation, give anaphylactic or allergic reactions. The more or less constant presence of the parasites in certain parts of the host's body makes the idea very plausible that the host is constantly charged with anaphylatoxins and it is quite possible that such a poisoning might lead to morbid conditions.

This hypothesis of a *parasitic anaphylaxia* raises many questions and opens a wide field to the investigator, such as:— the study of the consequences of anaphylactic poisoning and its relations with certain chronic diseases; practical application to the diagnosis of certain diseases; the study *in vitro* of anaphylactic sensitisation of parasitic origin, etc.

1257—Some Biological and Control Studies of *Gastrophilus haemorrhoidalis* and Other Bots of Horses, in the Dakotas and Montana, U. S. (1) — DOVE, W. E., in U. S. Department of Agriculture, Bulletin No. 597, 51 pp. + 4 Fig. + 5 Plates + Bibliography of 38 publications. Washington, April 6, 1918.

Three species of horse bots — the common bot-fly (*Gastrophilus in-*

(1) See also R. May, 1917, No. 458. (Ed.)

testinalis), the throat bot-fly (*G. nasalis*), and the nose fly (*G. haemorrhoidalis*) — occur in the United States, and each is a source of considerable injury to horses. This injury is produced through irritation caused by the flies at the time the eggs are laid and by the attachment of the larvae, or bots, in the alimentary tract.

Gastrophilus intestinalis and *G. nasalis* are widely distributed in the United States, but *G. haemorrhoidalis* is confined to the North-Central and northern Rocky Mountain States.

The nose fly (*G. haemorrhoidalis*) is by far the most annoying to horses at the times its eggs are laid. The adults appear early in June and reach the maximum of abundance during the first half of the season, disappearing with killing frosts. The eggs are deposited on the minute hairs on the lips, and those near the edges which are kept moist and receive friction hatch in from 5 to 10 days. The larvae are taken in with food or water and attach themselves to the walls of the stomach. Here they remain until the following winter or spring and then migrate to the rectum, where they reattach. Before leaving the host they usually attach close to the anus and protrude from it. They remain in this position from 40 to 70 hours. After dropping to the ground the bots seek protection and pupate in from 18 to 170 hours later. The pupal stage lasts from 21 to 68 days. The adults are very active and as they deposit only one egg at a time they are not so frequently seen about horses as are the adults of the common bot-fly. They take no food in the adult stage. Their length of life is from 1 to 7 days.

The throat bot-fly (*G. nasalis*) deposits its eggs on the hairs under the jaws and to some extent on the shoulders and other parts of the host. The larvae of this species attach themselves to the walls of the pharynx and also to those of the stomach and duodenum. They do not reattach in the rectum or at the anus as do the bots of the nose fly. Pupation occurs in from 1 ½ to 2 days after the larvae have passed from the host, and adults emerge in from 20 to 56 days later. The adults are somewhat longer lived than those of the nose fly. The flies cause considerable annoyance to horses during oviposition but not as serious as in the case of the nose fly.

The common bot-fly (*G. intestinalis*) usually appears later in the season than the nose fly and becomes most abundant just before killing frosts. The eggs are deposited on all parts of the body but preferably on the fore legs. They hatch upon the application of moisture and friction. From 9 to 11 days after oviposition appears to be the most favourable period for hatching, although some may hatch as early as 7 days and others as late as 96 days after oviposition. The larvae attach in any part of the stomach but the last-stage bots are found mostly in the left sac. They continue to drop from the host for a long period of time. Pupation takes place in protected places on the surface of the soil and the pupal stage lasts from 40 to 60 days.

All *Gastrophilus* larvae are surprisingly resistant to chemicals. The treatment of horses with carbon bisulphide in three doses followed by a

physic is satisfactory if administered in late autumn. Spring treatment is less effective, as the full-grown larvae are more resistant, and many of the nose-fly bots have left the stomach and passed back to the rectum at that time.

Larvae of *G. haemorrhoidalis* may be removed from the rectum mechanically, but this is laborious. The use of enemas containing insecticides is effective.

As a repellent, pine tar mixed with other material gave good results against the common bot-fly and the throat bot-fly. Such mixtures may be utilised to cause the flies to lay eggs on parts of the body less accessible to the horse's mouth.

Various nose protectors are in use against *G. haemorrhoidalis*, but there are objections to many of them. A piece of leather suspended below the lips from the bit rings is simplest and best. For animals on pasture a halter with a box-like arrangement and throat cover has been devised to protect horses against infection by all three species.

Kerosene oil used as a wash is ineffective in destroying the eggs of *Gastrophilus*. A 2 per cent nicotine-sulphate solution was only partially effective. Nitrobenzene gas yields good results at 25, 24 and 10 hours' exposure, but only a small percentage was killed at 4 hours. The phenol compounds, by a contact application, seem to be the most effective in destroying young larvae and preventing the further development of embryos. Carbolic acid containing 2 per cent phenols is satisfactory for destroying eggs when applied to the infested parts of the host.

1258 - **Experiments in the Transmission of Trichinae in the U.S.A.**—RAFFENSPERGER, H. B. (U. S. Bureau of Animal Industry, Chicago, Ill.), in the *Journal of the American Veterinary Association*, Vol. LIII, New Series, Vol. 6, No. 3, pp. 363-367 + Bibliography of 7 Publications, Ithaca, N. Y., 1918.

Certain workers (HÖYBERG, SALZER) have concluded that trichinosis may result from the swallowing of faeces or intestinal contents of animals harbouring the intestinal stage of the parasite. Other workers (LEUCKART, PAGENSTECHER, STÄUBLI) have concluded, however, that infection cannot be brought about through swallowing intestinal trichinae or the newly born larvae which may be found in the faeces of animals harbouring trichinae in the intestine. In the course of the author's investigations on trichinosis, he carried out some experiments similar to those of STÄUBLI. Rats and mice were fed on trichinous pork, and after their death, which occurred 2, 3, 4, 5, 7 and 10 days after the artificial infection, numerous live trichinae were found in the intestines. The contents of the duodenum and jejunum were fed to guinea-pigs; these were killed 40 to 50 days later, when their diaphragms were carefully examined under the microscope. The examination always gave negative results.

Concerning the stage at which trichinae in the muscles become infectious it is usually stated in the literature that non-encysted trichinae are not infectious. The author's results confirm this opinion:—rabbits, fed on trichinous meat, were killed 15 or 18 days later, when examination of

the diaphragm revealed the presence of many *unencysted* larvae. The fragments of the diaphragm were fed to other rabbits, which were killed after about 30 days; examination of the diaphragm, in this case, always gave negative results. But when the former rabbit had encysted larvae present in its diaphragm, that of the latter animal was also infected.

CONCLUSIONS:—The evidence obtained from the experiments supports the generally accepted opinions that trichinae are not transmissible through the faeces, that unencysted trichinae are not capable of developing when meat containing them is ingested, and finally that trichinae are spread from one host to another *only as a result of swallowing meat containing the encysted larvae of the parasites.*

1259 — **Cattle Lice and How to Eradicate Them.**—IMES, MARION, in *U. S. Department of Agriculture, Farmers' Bulletin* 909, 27 pp. + 14 Figs. Washington, February, 1918.

The bulletin under consideration treats of the following lice:— the short-nosed cattle louse (*Haematopinus eurysternus*), the long-nosed cattle louse (*Linognathus vituli*) and the common biting louse (*Trichodectes scabris*). The life history and habits of each are described. When separated from their host the first two species live about 7 days, the third one only about 4 days. Newly hatched lice only live 2 or 3 days if they find no host. The longevity of the lice and the viability of their eggs when separated from their host are of great practical importance in their eradication.

The parasites detached from the animals drop in the corrals, stables and pastures, and through the adults die in about a week, the eggs may hatch if the weather is mild and continue to infect the herds. Infected stables should be cleaned and disinfected with coal-tar creosote suitably diluted. Animals which have been dipped or otherwise treated to free them from lice should not be taken to contaminated quarters or those they occupied previously unless they have first been cleaned and disinfected or left vacant for about 20 days.

Methods of controlling cattle-lice are:—

1) Hand applications:— *a*) dusting powders (naphthalene and pyrethrum), which are useful in holding the parasites in check when the weather is too cold for dipping or spraying; *b*) greases:— cottonseed oil and kerosene in equal parts; $\frac{1}{2}$ pint of kerosene and 1 lb. of lard; crude petroleum; *c*) liquids.

2) spraying with a hand pump (or an orchard spray) with the liquids recommended for dips; two treatments should be given, 15 or 16 days apart.

3) Dipping in arsenical solution, coal tar creosote or nicotine.

The first two methods are suitable for small herds, the third (the most efficacious) is suitable for large herds. One arsenical or coal tar dip is usually sufficient to destroy the long-nosed louse and the common biting louse, but for the short-nosed louse two treatments at intervals of 15 or 16 days are necessary. The cattle should be well examined after the second dip as live lice sometimes remain and a third dip may be necessary about 16 days after the second.

The arsenical dip is made up of 4 lb. 85 % pure caustic soda + 8 lb.

99 % pure white arsenic in fine powder + 8 lb. sal soda crystals + 1 gallon pine tar + sufficient water to make 500 gallons. This dip is usually used cold, but, so as to avoid chills its temperature should be from 65° to 90° F.

Nicotine dips are very efficacious if they contain not less than $\frac{5}{100}$ of 1 % nicotine; if dips more concentrated than 0.05 are used they are dangerous to the cattle especially if used hot. They are usually given warm, but their temperature should not exceed 115° F. Flowers of sulphur is sometimes added to nicotine dips; it dissolves very slightly and clings to the animal's skin for a long time, thus helping to prevent re-infection.

Two dipping plants are described, one in wood, the other in concrete; both are similar in their general design to that described by the author for sheep (1). The length of the vat varies from 24 to 100 ft. according to the number of animals to be dipped, the width is about 3 ft. and the depth 8 ft. A plant should include pens for keeping the cattle in before and after dipping. The passage ending in a chute which leads to the dip must be well designed. The two plans given show the measurements and detailed construction of the vat, and running and crowding chutes. The plant is completed by a heating system. Attention should also be given to the easy draining of the water.

1260 - Avian Malaria Caused by *Plasmodium relictum* (Proteosoma);

Experiments in Algeria. — SERGENT, E. and E. (Pasteur Institute of Algiers), in the

Annales de l'Institut Pasteur, Vol. XXXII, No. 8, pp. 382-388 + 2 Figs. Paris, August, 1918.

For twelve years the authors have studied at the Pasteur Institute of Algiers avian malaria caused by *Plasmodium relictum*, which in many ways resembles human malaria. They now publish the still incomplete results of the 560 experimental cases observed.

INFECTION AND IMMUNITY. — All the canaries (560) contracted the disease as a result of bites from infected *Culex* or by intraperitoneal inoculation of blood of an infected bird. The course of the disease is similar with both methods of infection: — period of incubation, 3 to 10 days; period of acute infection, 9 days, with 61.3 % mortality. Relative immunity.

METHODS OF INFECTING THE BIRDS. — 1) Intraperitoneal inoculation; 2) rubbing *Culex* on to the skin of the canary (in the proportion of 4 cases out of 10); intrarectal injection (1 case out of 6).

MOSQUITOS SUBJECT TO INFECTION. — The complete sexual evolution of *Plasmodium* may take place in *Stegomyia fasciata*, *Culex sergenti* Theobald, *Theobaldia spathipalpis* Rondani, *Acartomyia mariae* Serg. and Theob. (the larvae of which only live in the salt water of hol lows in the rocks along the coast of the Mediterranean). The passage of *Plasmodium* to the eggs has not been observed and there is no acquired immunity amongst mosquitoes.

A description is given of the trypanosoma in the blood of the canary

(1) See R. 1917, No. 925.

(Ed.)

(*Serinus canarius* Koch), and of another trypanosome observed in the blood of the Algerian sparrow (*Passer domesticus* L.).

1261 — Complementary Studies on the Modification of the Germ Cells of Mammals; Effects of Inhalation of Alcohol Vapour on Guinea-pigs and their Progeny. — STOCKHARD, C. R. and PAPANICOLAOW, N. (Department of Anatomy, Cornell Medical School, N. Y.), in *The Journal of Experimental Zoology*, Vol. XXVI, No. 1, pp. 119-226 + 10 Tables + 9 Figs. + Bibliography of 18 Publications. Philadelphia, 1918.

The results of researches carried out for over 6 or 7 years with the aim of observing the modifications produced in the germ cells of mammals by the constant inhalation of alcohol vapour. Other experimenters, especially PEARL (1), using a similar method and technique to that of the author, have recently published the results of similar researches on other mammals or on birds. Although PEARL found the guinea-pig to be more sensitive to poisoning than fowls, the author is in agreement, speaking broadly, with that experimenter whose results he discusses at length.

1262 — Acorns as Food for Poultry. — CRANFIELD, H. T., in *The Journal of the Board of Agriculture*, Vol. XXV, No. 5, pp. 573-576. London, August, 1918.

The use of acorns as a substitute for maize in poultry feeding is recommended. Acorns have recently been recommended as a cattle food and PETERMANN (*Die landwirtschaftlichen Versuchstationen*, Vol. LXXXII, Pt. 1-2, p. 93) considered them a suitable poultry food after having been dried and ground. In the autumn of 1917 acorns of different varieties were collected, dried over a hot-water tank for several weeks, ground and sifted (the husks being thus completely separated from the kernel). The kernel (80 % of the acorn) showed the following percentage composition on analysis:—moisture, 13.86; oil, 4.57; albuminoids, 7.88; soluble carbohydrates, 67.82; fibre, 3.63; ash, 2.24. The meal thus obtained was fed to twelve pullets and five two-year-old birds, all in full lay. Before the experiment they were receiving fish meal, sharps, cooked vegetables, wheat screenings, oats and maize. The grain and sharps were gradually replaced by crushed acorns and acorn meal. The experimental ration was continued for four weeks. The birds suffered no ill effects. The acorns are slightly binding but counteract the rather laxative action of fish meal. There was no great difference in laying.

It has been stated (*Fühlings landwirtschaftliche Zeitung*, 1904, p. 808) that if acorns are fed to hens in too large quantities they cause black discolouration of the egg yolk (2). This defect was not observed during the author's experiment in which each hen received daily 2 oz. of acorn kernel.

CONCLUSIONS. — Acorns contain no substance injurious to poultry. Their food value is equivalent to a mixture of oats and maize. They may completely replace grain in poultry feed if their slight deficiency in protein is made up.

(1) For the technique of this kind of research and the results so far obtained, see the abstract of PEARL's three reports, in *R.*, September, 1918, No. 1018. (Ed.)

(2) See *R.*, 1915, No. 1067. (Ed.)

1263 - *The Tatu (Tatusia novemcincta) as a Pest of Farm-yards in Brasil.*—
See No. 1193 of *This Review*.

1264 - *Silkworm Rearing in Indo-China.*—GACHON, A., in the *Congrès d'Agriculture coloniale, Gouvernement Général de l'Indochine*, Haiphong Series, No. 7, 5 pp. Haiphong-Haiphong, 1918.

The cultivation of mulberry and silkworm rearing has been practised in Indo-China since remote times and, in nearly all the countries of the Union, silkworm rearing might be greatly and rapidly developed. Many circumstances have contributed to making prosperous this essentially agricultural and home industry. The mulberry grows easily and develops well. The worms may be reared throughout the year in some districts and during at least eight months in the least favourable ones. Abundant, cheap labour and the free time left by the small variety of crops grown are very important factors in the possible development of silkworm rearing.

France buys annually in the Far East raw silk to the value of nearly \$8 000 000, manufactures it and exports most of it as silk materials throughout the world. Indo-China might supply France very largely, as is shown by the quotations, with material equal to the best products of Canton, of raw silk and waste prepared by European methods chiefly in Tonkin and in Annam. These goods are already appearing on the French market. These considerations led the Government of Indo-China to encourage the improvement and development of the silkworm industry by all the means in its power, in order to export the produce to France.

The author (Inspector of the Agricultural and Commercial Services), after describing the cultivation of the mulberry and silkworm rearing in Indo-China (1), gives an account of the work done in the colony, especially by the Administration, to develop silkworm rearing. In 1905 the Administration appointed a silkworm egg specialist and founded an establishment at Phulang-Thuong for the production of eggs selected by the Pasteur method. At the same time pamphlets of a kind to be understood by the natives were drawn up in French, Quê-ngu, and Chinese. They gave simple, rational and practical methods for improving silkworm rearing, spinning and the preparation of waste, and were widely distributed in the silk centres and in all the provinces where they might have a useful effect.

Model and experimental silkworm nurseries and two egg-production establishments, one at Bach-hat (near Viétri) and one at Kiên-an (near Haiphong), were opened. The working of the egg-production centre of Phulang-Thuong, the oldest, best equipped and largest of the colony, was assured from 1907 to the end of 1916 by a commercial company controlled by the Administration and prepared to supply 3 000 000 layings. The establishment was taken under direct control on January 1, 1917, and its production exceeded 3 500 000 layings in 1917. The Bach-hat egg-production establishment, the second in importance, has been managed by the Administration since its foundation in 1914. It distributed free of charge

(1) This subject was studied by M. LEMARIE in the *Bulletin de l'Office colonial* and reviewed in *R.*, Sept., 1912, No. 1330. (Ed.)

600 000 layings in 1914, 1 000 000 in 1915, 1 650 000 in 1916, and about the same number in 1917. The Kiên-an egg-production centre was only established in 1916 and its production has reached 110 000 layings, in 1917 it exceeded 250 000. When the Phulang-Thuong establishment was opened a silkworm breeding research station was attached to it to study the introduction of foreign species, crossings, etc.

Of recent years Cochin-China, Annam, and Cambodia, following the methods used in Tonkin, have opened establishments for egg selection by the Pasteur method, model and experimental silkworm nurseries and plantations, as well as workshops for studying improved methods of silk spinning, the preparation of waste, and weaving for the European market. Since about ten years the Administration, especially in Tonkin, has made great sacrifices in order to develop the silkworm industry.

The silk-spinning basins has been altered and perfected giving as much consideration as possible to the native methods and customs. Many basins have been supplied free of cost to spinners who have thus been enabled to produce raw silk saleable in France either as they arrive or after a very simple system of re-reeling and re-boiling. The waste and by-products of the spinning industry, prepared by a rational, more profitable method than formerly, may now easily be exported to France. A premium of \$ 0.80 per kg. (about 9d. per lb.) was instituted in 1907 and continued till the end of 1915 in favour of steam spun or reeled raw silk exported to France, in order to help and encourage those engaged in the trade. There are three steam spinning mills in Tonkin: — 1) that opened in 1906 at Nam-dinh, the most important, with 100 basins; 2) that of Thai-binh, opened in 1909, with 40 basins; 3) that of Kiên-an, opened in 1915, with 60 basins. A fourth is to be built during 1918 at Viétri. Large numbers of improved direct basins spinning for export, have been set up in the provinces of Nam-dinh, Thaininh, Ninh-binh, Haidong, and at Bach-hat. Certain mills, better equipped than others, have boilers for heating the water of the basins by steam, a more regular method than by wood, but the reeling apparatus is always on the model or that recommended by the Administration.

The European silk industry has been centred in Annam in the Binhdinh, at Phuphong, near Quinhone, since 1903. A French company owns there a spinning mill with 100 spinning basins, a silk-twisting machine and a large weaving machine. All the products, raw silk, waste, and materials (crepe, crepon, pongee, etc.) are exported and sold in France.

The Annam Protectorate has installed in various silkworm rearing centres, small egg-producing establishments managed by native agents of the local Agricultural and Commercial Services under the direction and supervision of French officials of the Service. As in Tonkin these small establishments work in co-operation with the model silkworm nurseries, or obtain their supplies from rearers who have specialised in egg production.

In Cochin-China an Annamite company for spinning and weaving silk by European methods was founded at the beginning of 1914. A factory was built for receiving the material which has not yet been delivered, owing to present conditions. The Orphanage of the Sisters of Culac-Gieng has a

hand-weaving factory and a factory for crepons, pongees, figured silk and silk embroideries for the European markets. In spite of somewhat primitive equipment the products of this industry are very satisfactory and find a ready sale. The local body of the Agricultural and Commercial Services has two egg-production centres, one at Saigon and one at Tân-Châu, supplied by model silkworm nurseries belonging to the Administration and expert rearers. Many model nurseries and mulberry plantations, each having a small factory for silk spinning and weaving by improved native methods, have been established in silkworm rearing centres. Each year the Agricultural and Commercial Services of Cochin-China distribute gratis an average of 1 million selected layings. Cambodia has an egg-production establishment supplied with cocoons from model nurseries or produced in chosen centres by careful breeders. The selected eggs are distributed free of charge to all breeders who apply for them, an annual average of 1 million layings being distributed among the silkworm districts of Cambodia.

A silkworm-rearing research station has been opened at Phnompenh and has already given interesting results. Varieties of native worms have been most carefully selected and have given very strong white and yellow types of very pure colour. The experimental spinning and weaving factory has attracted the attention of the French and Cambodian populations and a company was recently formed to start a steam silk spinning factory with 200 basins and, later, a factory for machine weaving.

The reduction of the taxes on mulberry plantations made in 1905 by Governor General BEAU has given good results but less far-reaching than was expected, by reason of the native communal organisation and the payment of taxes by villages. The conferment of honorary rewards, of small grants and prizes given in competition would appear to have more opportunity of starting a movement for the extension of mulberry plantations and the improvement of silkworm rearing methods and the silk export industry.

For several years the "Musée agricole et commerciale" of Hanoi, belonging to the Agricultural and Commercial Services of Tonkin, has given professional instruction to numerous Annamites. A model silkworm nursery and mulberry plantation, a set of direct basins and several improved weaving looms, make it possible to follow the full cycle of the silk industry. This instruction has proved most useful and many Annamites owe new means of earning to it. It has made possible small home industries which need no help from the Administration. Although the silk industry workrooms of the Hanoi Museum have had to make room for other trades, equally interesting as home industries, the instructors continue their work in the province and also in other countries of the Indo-Chinese Union (Cambodia, Cochin-China, Annam).

All Indo-China is wonderfully well suited to the development of the silk industry. A large market for the products is assured as raw silk materials have taken first place among the exports of the Far-East to France and woven silk materials are the most important exports of France. The

export of raw and woven silk to France did not exist about ten years ago; now its value exceeds 1 million francs (£39 649) for Tonkin and $\frac{1}{2}$ million for Annam. Some Chinese merchants export native silks and silk waste to Hong-Kong, Malaya and Siam. This trade has decreased greatly in Tonkin and Annam, but is still flourishing in Cambodia and Cochin-China. It is to be hoped that it may be completely replaced by an industry exporting all its products to France.

1265 — Complementary Notes on Fish Breeding in Rice Fields, in Madagascar. — LEGENDRE, J., in the *Revue Agricole et Vétérinaire de Madagascar et Dépendances*, Year III, No. 19, pp. 227-228. Tananarive, 1918.

Further advice is given (1) on the breeding of carp in rice fields, recommended both as a source of extra food for the natives and as a means of destroying mosquito larvae which live in the irrigated crop and transmit malaria (2). The carp are put in the rice fields eight days after transplanting if possible, and, at any rate, as soon as the water is there permanently. The depth of water most favourable to the growth both of the rice and the carp is from 3 to 6 inches. If the fish are about 3 inches long, two should be placed per square metre (1.19 sq. yards), if they are smaller, four or six per square metre. It is wise to put in some 2-inch long fish as these have reached the age for reproduction and may spawn in the rice fields (spawning in September, October and November).

To keep the fish in the field the holes by which the water enters and leaves it must be covered with wicker-work made with branches 0.04 to 0.08 inches apart, either crossed, or arranged parallelly and vertically and joined transversally. After the harvest the fish are collected, the largest (at least 3 inches without the tail) eaten and the rest placed in a reservoir till the next rice season. This reservoir may be a hole dug in the soil capable of holding at least 11 lb. of carp per cubic metre (1.30 cubic yards) of water, but a small pond is preferable. The fry feed on the aquatic animalcules, which the larger fish of the rice fields refuse, so that the fish production of the field is increased.

The author estimates that a well-stocked rice field should yield in four or five months ten-times the weight of fish it received.

1266 — The Fennec Fox in Captivity to Replace the Domestic Cat. — CRÉPEL, P., in the *Bulletin de la Société Nationale d'Acclimatation de France*, Year LXV, No. 8, pp. 225-228. Paris, August 18, 1918.

The fennec fox (*Canis zerda*), so little known at present, is of a certain interest. This pretty little North-African fox is easily tamed and, though it is not common, would be of great service to agriculture could it be reared.

It destroys cockchafers, locusts and crickets, all kinds of injurious insects, rats, it is as clean as the cat, requiring no previous training;

(1) See R. May, 1917, No. 472. (Ed.).

(2) To control malaria the breeding of other species has also been recommended, amongst them *Gambusia affinis*, a hardy, tiny fish, doing well in shallow water and in ponds containing less than 1.14 inches of water. See R. March, 1918, No. 251. (Ed.)

it takes up little space, does not smell, eats almost any thing, destroys less small birds than the cat, for it cannot climb trees, and is a pleasant companion, with a fine coat. It might well replace the cat as it has more advantages without the serious defects of the latter.

[FARM ENGINEERING.]

1267 — **Trials of Machines for Cultivating Vineyards Organised at Montpellier and Roche-de-Brun, France, in 1918.** — I. FERROULLAT (Director of the National School of Agriculture at Montpellier), in *Feuille d'Informations du Ministère de l'Agriculture*, Year XXIII, No. 25, pp. 6-7. Paris, June 18, 1918. — II. CASTEX (Director of the Vienne Agricultural Department), *Ibid.*, Year XXIII, No. 30, pp. 3-4. Paris, July 23, 1918.

I. — The trials took place in May in a vineyard on the Rochet estate, near Montpellier, in an easy, sandy soil in perfect condition. Part of the vines are planted about 59 in. apart in the lines, which are 6 ft. 6 in. apart; there are headlands from 13 to 16 ft. wide at each end and the rows are from 812 to 1 000 ft long, thus providing favourable working conditions for tractors.

The CHAPRON TRACTOR (1), which took part, was tried with a small 3-furrow OLIVER plough working a width of 28 in. and a spring tine Canadian harrow covering a width of 59 in. While there M. CHAPRON designed a machine capable of cultivating the whole space between the lines (69 in.), which consisted of a triangular frame, in the centre of which in front was fixed a drill plough, while 3 small AUBERT ploughs (Montpellier) were fixed on each side like stubble ploughs, thus making 7 working parts in all. Although not quite successful, after a slight modification the machine improvised in this way did not work badly.

The tractor, tried with the 3 machines mentioned, worked perfectly and did no damage whatever to the vines. The last day was employed in dynamometric and fuel-consumption tests. The results, given in a table, show that the tractive effort per sq. decimetre (= 1.55 sq. in.) of section of the strip of earth worked is very low (60.7 lb. with the Oliver 3-furrow plough working 6 in. deep and 57.8 lb. with the same ploughing at a depth of 5 in.; 32.8 lb. with the CHAPRON gang-plough working at 2 to 3 in. deep, and 46 lb. with the same plough loaded with 297 lb. and ploughing 5 in. deep; 45.3 lb. with the Canadian harrow working at 4 in. deep. As the soil was sandy, the surface layer was perfectly broken down. Occasionally the tractive effort attained high figures, but without decreasing the speed of the machine, thus showing that its limit of traction was much higher.

As regards fuel consumption, in a first trial, an engine standing still while running at 1400 revolutions per minute consumed 0.44 galls. of petrol (density : 0.730) per hour; in 2 other trials the tractor, towing the 3-

(2) See *R.*, October, 1918, No 1145, (*Ed.*)

furrow OLIVER plough and ploughing 5 in. deep in the one and 7 in. in the other (in relation to 28 and 32 in. of width and furrow lengths of 934.3 and 959 ft.) consumed 4.18 galls. in the first trial and 4.65 galls. in the second, which corresponds to 1.18 and 1.50 galls per acre of vineyard.

In the first trial the speed was 1.86 miles and in the second 2.37 miles. The time theoretically required to plough 1 acre of vineyard was 94 minutes in the first case and 70 minutes in the second; in practice $\frac{1}{3}$ more is needed, giving 125 and 93 minutes respectively.

The author observes that the fuel consumption of the engine is neither the only nor most important factor in judging the value of a tractor. The essential is to have a well-built strong machine with parts of easy access and maintenance, even if it does consume more petrol than another machine. Moreover, the fuel consumption varies from one machine to another and depends, in a certain degree, on the skill of the driver.

The CHAPRON tractor has a low fuel consumption and has some good points in its construction. The author thinks, without giving a final opinion, that the tractor seems suitable for viticultural work and is well worth note.

II. — Eleven makers had entered in June for the tests at La Roche-De-Bran (Vienne), but, owing to transport difficulties only 7 machines actually took part.

The Roche-de-Bran estate vineyard has a marly, slightly stony soil which is in very good condition. The vines are planted in rows 6 ft. 6 in. apart. Part of the vines are trained on iron wire. The branches are attached to the pole that supports each plant; the long branches are propped between the plants in the direction of the lines, which increases the difficulty of mechanical cultivation. The lines are 600 ft. long and the headlands are 13 ft. wide. Plots of about 5 acres each were numbered and allotted by drawing lots, to each the makers taking part in the trials.

In 1917, only two foreign-made machines for the mechanical culture of vineyards took part in the Mettray (1) trials; at La Roche-de-Bran 4 French makers showed quite new types of machines, which show certain progress in adapting the tractor to vineyard cultivation. The author recalls that in order to plough 4 to 6 in. deep and scarify 2 in. deep in hill or plain vineyards, M. RINGELMANN, in his report on the mechanical cultivation of vineyards (2), estimates that the machine should have a maximum width of 3 ft. 3 in., while the tractor and the machine it hauls (plough or cultivator) should be able to turn on a headland no wider than 10 ft., the total weight of the machines not being greater than 2420 lb. These tractors should also be utilisable for sulphating, sulphuring and road transport. In addition when hoeing and weeding drilled crops it is necessary that the distance between the front wheels and the back wheels can be modified so as suit the width of the drills. The outer edges of the tyres should be about 8 in. from the axis of the seed-bed or of the plantation to be hoed or weeded.

Amongst the machines tested the author describes:—

(1) See *R.*, 1917, No. 940, (*Ed.*), — (2) See *R.*, 1917, No. 841. (*Ed.*)

1) the 12-20 H.P. Cleveland (1), chain-track tractor, presented by the ALLIED MACHINERY Co. of France, 19, rue de Rocroy, Paris.

2) The tractor entered by the AMERICAN TRACTOR Co., 11 and 13, avenue du Bel Air, Paris.

3) the CHAPRON tractor (2) which ploughed and scarified the vineyard as well as ploughing 8 in. deep with a 2-furrow plough in ordinary soil and hauled with ease a mower for cutting hay in a meadow.

4) the vineyard tractor of the COMPTOIR ANGLO-FRANCO-RUSSE, 19, Avenue de l'Opera, Paris; 4 HP. at the pulley and 1.25 HP. at the draw-bar; runs at 230 to 2000 revolutions per minute, 0.93 and 3.1 miles per hour on the road, 0.6 to 1.8 miles on ploughed land; weight 451 lb.; height 3 ft. 3 in. This machine hauled a machine-hoe that hoed and weeded in two successive turns on the same strip.

5) the tractor entered by MM. F. GROS & BOUCHARDY fitted with a 10 H.P. DESSAULES engine, running on paraffin or petrol.

6) the PAX motorplough of MM. FRANCFORT & SEGUN, 144, Rue de Charonne, Paris. The 2-cylinder vertical 6-8 HP. engine of this tractor runs at 800 revolutions and is placed in front of the axle; the makers state that it requires 3.3 galls. of petrol and 4.4 lb. of oil per day. The tractor is guided by means of 2 stilts placed behind the frame. Its total width is 3 ft. 3 in., its length is 10 ft. 6 in. and its height 3 ft. 3 in.; it weighs 1650 lb.

7) the No. 1 "Simplex Viticultural" tractor of SCHWEITZER & Co., 86, rue de Flandre, Paris, is built especially for cultivating vineyards; it is only 2 ft. 9 in. broad, as that it can easily pass amongst the rows of vines. The machine hauled a Canadian harrow and a vineyard plough. The implements hauled can be controlled directly by the driver without him having to leave his seat. The 4-cylinder, 10 HP. engine has 2 speeds and its single reverse runs at 2.5 to 3.1 miles per hour; the two driving wheels are braked separately. The tractor weighs 1540 lb. and it is 8 ft. 3 in. long; its declared fuel consumption is 0.88 to 1.1 galls. of petrol per hour.

All these machines worked well during the test period, without damaging the vines in spite of the difficulty resulting from the fact the long branches were supported over the soil and might have been caught by the working parts in passing.

1268 - **Tractor Operating Data in the U. S. A.** — *Official Report of the University of Illinois, Division of Farm Mechanics, in The Implement and Machinery Review, Vol. XLIV, No. 520, p. 412, London, August 1, 1918.*

Early in 1917 the Division of Farm Mechanics, the University of Illinois, U. S. A., sent to 60 tractor operators in the State of Illinois record sheets, arranged for the purpose of enabling the farmer to keep a yearly record of his tractor operations. When returned, 22 reports were found to have been carefully kept. A summary of the data obtained is given in the appended table. It should be remembered that these data have been ob-

(1) See *R.*, October, 1918, No. 1145, (Ed.) — (2) See *R.*, October, 1918, No. 1145, (Ed.)

tained from a limited number of successful operators. In only one case (tractors with kerosene-burning motors pulling 3 ploughs) is the number of operators large enough to warrant the drawing of general conclusions.

Summary of tractor-operating data, Illinois, 1917.

Fuel used	Gas	Gas	Kerosene	Gas	Gas
Operators reporting	2	4	14	1	1
No. bottoms on plough used	2	3	3	5	6
Original cost of tractor \$	827.50	1041	797.57	20.20	2 610
Years since purchase	1.5	2.51	1.96	4.5	2
Different days used	32.5	37.25	42.41	58	33
Hours used	219	264.25	293.14	363.5	302.5
Hours trouble	6	17	16.29	6.25	4.75
Percent time-trouble	2.74	6.43	5.55	1.72	1.57
Fuel cost \$	80.50	109.54	60.28	269.30	360.55
Lubricants cost	20.45	18.08	19.45	35.53	15.51
Repair cost	4.55	43.15	38.10	36.33	2.50
Miscellaneous cost	4.85	4.57	7.54	20.44	6.95
Operating cost per season	110.35	175.34	125.43	354.60	385.51
Depreciation, 20 %	165.50	208.25	159.51	404.00	522.00
Interest	29.79	37.8	28.71	72.72	93.96
Total cost per year	305.64	421.07	313.65	829.32	1 001.47
Percent repair cost of original cost	0.55	4.14	4.78	1.80	0.096
Acres in farm	238	240	258.57	271	675
Acres cropped	202	199.75	213.63	200	675
Acres maize	131.5	84.5	89.13	60	297
Acres oats	70.5	52.5	66.25	110	120
Acres wheat	—	10.0	17.30	—	—
Acres hay	—	42.75	35.93	—	258
Acres miscellaneous	—	10.00	5.28	—	—
Horses used before tractor was purchased	11.5	7.0	9.5	18	24
Horses used after tractor was purchased	8	5.0	7.35	18	12
Horses displaced	3.5	2.0	2.15	—	12
Gallons gasoline	407	527.25	43.8	1 265.5	1 765
Gallons kerosene	—	—	548.5	—	—
Gallons fuel per hour	1.86	1.995	2.02	3.48	5.83
Cost gasoline per gallon, cents	19.7	20.77	20.44	20.56	20.42
			9.34		

SIZE OF TRACTORS.— One tractor was of 6-12 H.P., 4 were of 8-16 H.P., 9 of 10-20 H.P., 6 of 12-25 H.P., 1 of 20-40 H.P., and 1 was of 25-40 H.P. Three of the users of 8-16 H.P. machines desired a larger tractor; 3 users of the 10-20 tractors believed that a larger machine would be better adapted to their conditions; only 2 men, one using a 10-20 and the other a 20-40 desired a smaller machine.

TYPES OF DRIVE.— 21 machines had wheel drives and 1 had a caterpillar type of drive. Sixteen of the 21 wheel machines had 2 drive wheels. Of the 5 operators whose machines had other than the 2-wheel drive, 3 expressed preference for a 4-wheeled machine with 2 drivers.

HIRED HELP. — The hired help bill was reduced by 10 farmers. The amount of reduction reported varied from $\frac{1}{3}$ to $\frac{2}{3}$ of the previous help bill. One farmer operating 320 acres reported that he had been able to dispense entirely with the services of one man.

SOIL PACKING. — 10 operators reported no soil packing; 6 reported packing when the soil was wet; 2 reported packing of maize ground; 3 reported beneficial effects from packing, and one made no report on this question.

PRICE OF TRACTORS. — Practically all the machines were purchased at pre-war prices. To-day the same machines would cost from 60 % to 100 % more, which would materially increase the depreciation charge.

TROUBLE. — The % time-trouble is obtained by dividing the hours trouble by the hours used and multiplying by 100. The relatively large % time-trouble reported for gasoline tractors pulling 3 ploughs is due almost entirely to one operator who used a tractor having a 2-stroke cycle motor. Omitting the report of this man the % time-trouble for this class of machine is 4.15.

DEPRECIATION. — The annual depreciation is estimated at 20 % of the original cost of the tractor.

INTEREST. — The interest (6 % per annum) is thus estimated: — Add the original cost and the annual depreciation; divide this sum by 2; and multiply the quotient by 0.06.

HORSES. — Fifteen of the 22 operators replaced one horse or more by the use of the tractor. These data indicate that on the average a man farms 22 crop acres per horse without the use of a tractor and 29.7 crop acres per horse when the tractor is used. Nine operators stated that the tractor enabled them to use either lighter horses, more brood mares or young horses.

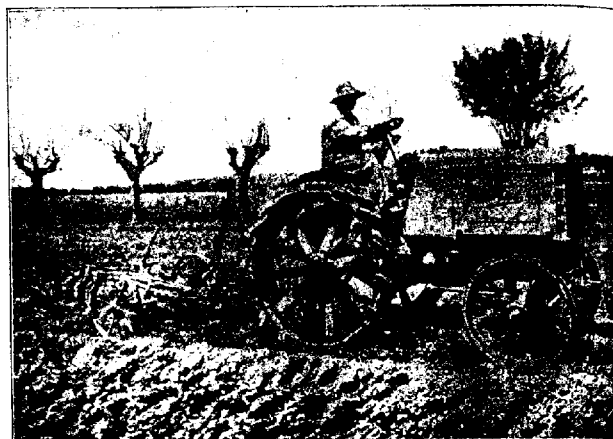
1269 — **The "Fiat" Tractor.** — SIGNORINI, M., in *Il Coltivatore*, Year LXIV, No. 24, pp. 503-504 + 1 Fig. Casale Monferrato, August 30, 1918.

The Italian-made "Fiat" tractor was tested successfully on August 27, 1918 at the Marchesa farm near Turin.

This tractor, shown in the appended figure, is of 18-20 H.P.; the engine has 4 cylinders (100 × 180) and it has 3 speeds — 1.4, 3.1 and 3.7 miles per hour; it weighs 5280 lb. and has a draw bar pull of 3960 lb. in the first speed and 2200 lb. in the second; it is 53 in. wide. Towing a 3-furrow plough at 8 in. deep it can plough 64 584 sq. ft. per hour, consuming 19.8 lb. of paraffin. This tractor can be used for towing vehicles on the road as well as for hauling machines for cultivation and for gathering crops. In addition, by means of a pulley, the "Fiat" tractor can be used to drive threshers and fixed farm machinery.

According to the author, the "Fiat" tractor has been built to meet the needs of Italian agriculture; it is strongly made, easily handled and smooth running; it suits large and medium sized farms.

The price of the tractor is not yet fixed, but it will not cost more than the foreign tractors imported into Italy.



"Fiat" tractor at work.

1270 - The Haulage of Ploughs. — RINGELMANN, M., in the *Comptes Rendus de l'Académie d'Agriculture de France*, Vol. IV, No. 27, pp. 746-748, Paris, July 24, 1916.

The author has previously shown that ploughing requires 80 % of the total energy necessary for cultivation.

Suitable weather for ploughing is generally limited in extent. Ploughing is not done under good conditions unless the soil contains from 9 to 10 % of water, 11 to 17 % being considered the optimum; at more than 21 or 22 % of water, the ploughing becomes bad. The water content of the soil, apart from the purely cultural point of view, has an influence on the wear of the parts, on the stability of the machine and, above all, on the tractive effort required by the plough.

As regards wear, in a good light potato soil (tertiary soil of the Grigny Plateau, Seine-et-Oise, France), the ploughshare has to be set 6 or 7 times per acre in dry summer weather. Each setting cost about 7*d.*, working out at 3*s.* 6*d.* to 4*s.* 1*d.* per acre. In September, when the soil is wet by the rains, one setting suffices for about 3 ³/₄ acres. Under the conditions of the present case one share is completely worn out after ploughing 44.5 acres and to replace it costs 6*s.* 3*d.* for ordinary steel and 10*s.* 5*d.* for hardened steel.

The tractive effort per sq. decimetre of section ploughed increases

[1269-1270]

for the same plough in the same soil in measure as the soil dries (the average density is 2 304 in tertiary soil).

The tractive effort for the plough at different dates and for ploughings comparable one with the other as regards dimensions was 47 kg. per sq. decimetre for a soil water-content of 15.4 %; 46.1 kg. for 11.1 % of water; 70.7 kg. for 5.1 % of water; and 78.2 kg. for 3.8 % of water.

The shape of the working parts also influences considerably on the traction. Thus, on the same length, at an interval of half an hour, a plough requires, for the same ploughing, from 1.40 to 1.42 times the pull required by a model of better design or more suited to that particular soil.

As the periods during which the soil are in such a state of humidity as to work well are generally limited, power farming has the advantage that, with it, the farmer can work his land in the desired time.

1271 - A Tractor Plough. — DESSAISADE, R., in the *Journal d'Agriculture Pratique*, Year LXXXII, Vol. XXXI No. 17, pp. 329-330 + 1 Fig. Paris, August 22, 1918.

When a vehicle moves up a slope its resistance increases with the steepness of the slope. The motor drawing the vehicle up the slope uses a certain amount of energy to move itself, so that there is a reduction of the amount of tractive energy available for the vehicle or machine to be towed. This loss is due to the elevation of the motor on the inclined plane and is independent of the nature of the motor. For example, a tractor weighing 6160 lb. which gives an actual pull of 1672 lb. on level ground, and hauling a plough requiring an average tractive effort of 440 lb. per furrow, will give a pull of 1320 lb. for 3 furrows and 880 lb. for 2 furrows on level ground.

If this tractor mounts a 10 % slope, its possible tractive effort drops to 1661 lb. owing to the decreased pressure of the driving wheels on the soil, and the tractor itself requires 616 lb., so that if it gives a pull of 1672 lb. on level ground, it can only give a pull of 1045 lb. when mounting, which is insufficient for opening 3 furrows, but more than sufficient for opening 2 furrows. The tractor must, therefore, be handled in such a way that, in ascending, only 2 furrows are opened, while, in descending, 3 furrows are opened at the same time.

Therefore tractor ploughs destined for use in steeply sloping land should be arranged in such a way that, by moving a simple lever, the number of plough bottoms working could be rapidly changed.

MM. DE LACOUR and FABRE, 4, Avenue de Villiers, Paris, have exhibited at the Noisy-le-Grand (France) official trials a GALLOWAY plough (1) built according to the principle described above. It is a 3-furrow plough, and, for slopes, the third plough can be raised by moving a lever, when only 2 furrows are ploughed.

In considering the application of mechanical cultivation to the uneven ground in Scotland, the Highland and Agricultural Society of Scotland had laid down the condition (2) that ploughs intended to work on hilly ground should be made in such a way that they could be quickly changed at the

(1) See *R.*, Oct. 1918, No. 1145. (Ed.) — (2) See *R.*, Feb. 1918, No. 100. (Ed.)

end of the furrow so as to plough 2 or 3 furrows according to whether the tractor ascended or descends the sloping field.

The GALLOWAY plough fulfills the condition, which is applicable to so much cultivated ground.

1272 - The BÉFORT and Gaillard Electric Ploughing Set. — *Le Génie Rural*, Year X, No. 83, p. 14 + 2 Figs. Paris, 1918.

In this system — now on trial near Paris — the electric current does not come from a section but from a generator forming part of the set. The makers thus use electricity as a mechanical organ acting at the point where



Generator.

Front view of windlass.

it is required, and give that organ all the independence of the other organs forming the set. They are thus able, just as with a petrol engine and with just as much freedom, to generate the power at the required place and when required.

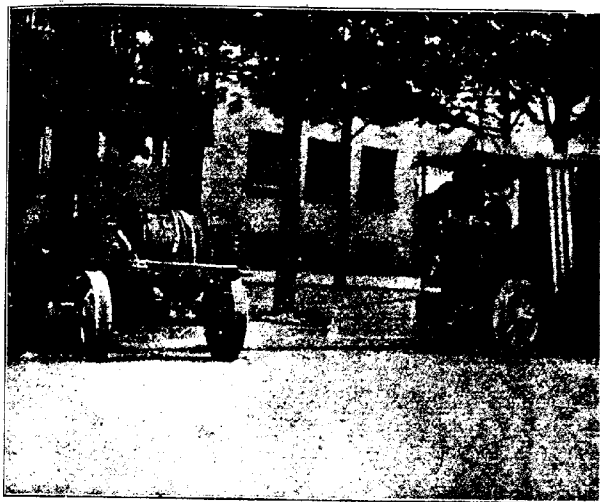
By transforming the initial power into auxiliary current, the makers claim that the power actually available is much greater than the same power used as a tractor in direct traction.

The BÉFORT-GAILLARD system, using a single generator with a minimum cost, has the advantage of always giving direct traction, the generator serving equally as tractor for the set, and all the ploughs of the farm.

[1271-1272]

The set offered to the French Ministry of Agriculture consists of a steam-generator, working very smoothly and easily controlled. The generator is always supplied with water and coal for a 10 hour's run, i. e. for 1 day's work without further supplies. It thus forms a mobile station going where wanted, when it has to supply its 2 sub-stations.

Cable-ploughing sets with a single generator all require a return cable



Rear view of windlass.

Generator.

or a return pulley. By doing away with the return pulley MM. BÉFORT and GAILLARD obtain a yield of 86 % of energy available at the draw bar.

To provide for unforeseen resistances and all the strains of traction, a good amount of reserve power must be available. At a speed of 85 cm. per second — a good practical speed for all hard work — the tractive effort is 1800 kg. Taking as basis a 5-furrow balance plough working at a depth of 20 cm. and meeting a resistance of 55 kg. per sq. decimetre, the tractive effort is not over 900 kg.; the reserve power is thus amply sufficient meet all possible needs.

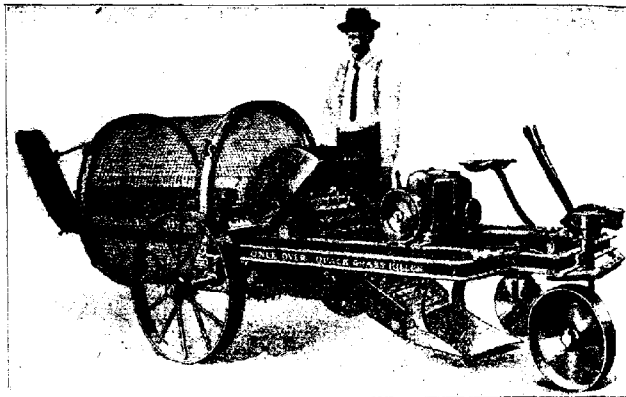
The BÉFORT and GAILLARD set have the following interesting characteristics: — front swingle-trees with automatic decentering, so that cable traction can be used (without an auxiliary return of the cable) for drilled crops; a draw-bar hook buffering and controlling the traction.

1273 - The "Once-Over" Quack Grass Killer. — *The Implement and Machinery Review*, Vol. XLIV, No. 520, pp. 415-416 + 1 Fig. London, August 1, 1918.

The QUACK GRASS EXTERMINATOR Co., 912, Andrus Building, Minneapolis, Minn., U. S. A., makes a new machine for exterminating weeds, particularly couch grass. By running this machine once over a field (whence its name), practically every vestige of crop-killing weed is said to be exterminated.

This new device, shown in the appended figure, resembles a tractor, but does not propel itself. Its petrol motor serves to operate the mechanism while the machine itself is hitched to a tractor or drawn by horses.

The machine consists of a framework mounted on wheels, carrying at its forward end an ordinary plough, minus the mould board, behind which



"Once-Over" quack grass killer.

is a toothed cylinder, followed in the rear by an elevator running backward and upward at an angle of about 40° into separating mechanism, which, in turn, is followed by a large circular sieve moving in an anti-clock direction as the machine travels forward. Inside the reel or sieve is a horizontal conveyor running to a perpendicular elevator swing in the rear of the machine for conveying the weed refuse into a wagon driven alongside.

The operation of the machine can be described as follows:— The plough share located at the forward end is 16 in. wide and set to run at a depth of 4 to 6 in.; the ribbon of soil cut is passed back, there being no mould board, and brought into contact with the teeth of the forward cylinder which cuts and shreds up the weeds and soil. At this point about 60 % of the soil is returned to the earth and the weeds, stalks, etc., are elevated into the separating machinery, where a system of separation, not unlike that of a

wheat or small grain threshing outfit, separates the weeds and 20 % of the soil, the latter being returned to the ground. All the weeds and roots and the remaining 20 % of the soil pass into the revolving sieve in the rear. The soil is completely lost through the meshes of this sieve, and the weeds are carried upward by the revolving screen and dumped into the horizontal conveyor, in which they are carried to the perpendicular elevator in the rear, where they are elevated into a vehicle to be carted away and burned, or otherwise destroyed.

A field is thus left in a condition free from all weeds, roots and other noxious growths and in a thoroughly tilled condition, ready to be sown at once if desired. The machine has a capacity of 3 to 5 acres per day, according to the nature of the soil, the thickness of the ground and the speed at which the machine is towed.

This new tool is said to be strongly made and should last from 5 to 8 years; its estimated cost is £ 200.

274 - **Motor-saw Mounted on a Hand-cart.** -- *La Terre Vaudoise*, Year X, No. 27, p. 249 + 1 Fig. Lausanne, July 6, 1918.

Messrs MÉGEVET of Geneva make a circular motor-saw for cutting fire wood; the saw is driven by a petrol motor, the whole being mounted on a small hand-cart.



MÉGEVET motor-saw mounted on a hand-cart.

The motor is of the FÉLIX-MÉGEVET type; it is simple, light and runs well. By adding another cylinder, the maker has improved on the old, one-

cylinder type. As is shown in the figure the MACEVET wood sawing plant is completely independent and can be moved and set up anywhere in the forest or at the farm. Its small size enables it to pass easily into restricted spaces. Its easy transport and use gives it a claim for superiority over other systems.

The circular saw, with its roller-table and well protected blade, is very safe and easy to work. The engine drives directly on the shaft of the circular saw by means of a horizontal belt. The whole plant is strongly built and all the parts are easily accessible.

The engine consumes little petrol. By using this motor saw (1), great economy in labour can be made while the work is done more quickly.

1275 - The Marmier and Canonne Apparatus for Drying and Concentrating Liquids at Low Temperatures. — MARMIER, L. (Assistant Director of the Pasteur Institute at Lille), in the *Annales de l'Institut Pasteur*, Year XXXII, No. 4, pp. 145-149 + 2 Figs. Paris, April, 1918.

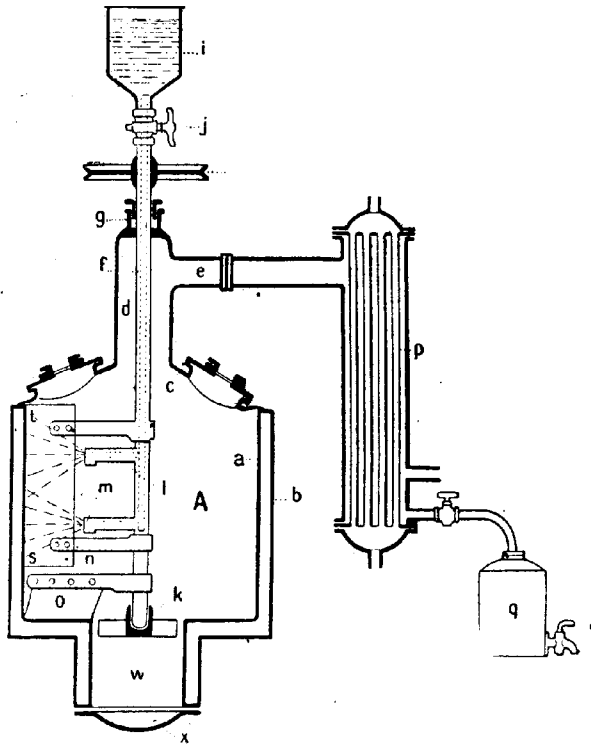
Many liquids of organic origin, such as albumin, fresh grape must, milk, etc., can be kept a long time without any fermentation taking place if they are dried or even when sufficiently concentrated. To do this, they cannot be boiled at atmospheric pressure and often they cannot be heated to about 60°C without running the risk of changes taking place in their composition. To enable such liquids to be dried or concentrated at low temperatures while retaining all their properties MM. MARMIER and CANONNE have designed an apparatus (see Fig.) which is constructed as follows: —

The desiccator consists of a closed cylindrical boiler *A* with double walls *a* and *b* between which circulates hot water maintained at the required temperature. The upper wall *c* has an outlet tube *d* communicating by a pipe *e* with a condenser *p*; this would be, for example, a tubular condenser whose tubes are water-cooled internally. The steam given off in *A* condenses on the outside of the tubes and the liquid thus obtained is collected in a tank *q*. A vacuum pump maintains a suitable vacuum throughout the apparatus. The liquid to be treated, coming from a recipient *i* having the tap *j*, is distributed through the boiler by means of a hollow shaft *f* traversing the gland *g* and rotated by the pulley *h* or a cog-wheel.

Several radial tubes *l*, fixed on the shaft and communicating with the hollow interior, end in a nozzle *m* spraying the liquid in a fine spray on the chamber walls *a*. A scraper *s*, carried by the arms *n*, is mounted on the shaft which carries it round when rotating. It touches the cylinder walls removing the concentrated or dried liquid deposited on the walls by the spray. A second scraper *o* is placed at the lower part of the shaft, and is so placed as to bring the dried product into a recipient *w*, from which it is removed at the end of the operation by the plug *x*. The apparatus works in the following manner: —

(1) The motor-saw with 1-cylinder, 3-II.P. FÉLIX engine costs 2900 Swiss francs; the with a 2-cylinder 6-H.P. FÉLIX engine costs 3500 Swiss francs. (Ed.)

When the water-bath is at a suitable temperature, the tap *j* is closed, and a vacuum produced. The reservoir *i* is filled with the product to be dried or concentrated; the shaft is set turning, *j* is opened; the atmospheric



MARNIER & CANONNE apparatus for drying liquids at low temperatures, Section.

pressure forces the liquid into the hollow shaft and into the jets. The liquid is spread in a thin layer on the heated wall and quickly evaporates. The rate of spraying and the speed of rotation are regulated in such a way that the product deposited on the wall is dried or concentrated to the

[1275]

required degree before the spray passes again. The scraper *st* removes the product, which falls to the bottom and is scraped into the recipient *to* by the scraper *o*.

For small flows, jets with very fine holes are used. As there is a certain minimum size, especially for viscous liquids or those containing solids in suspension, beyond which the jets become stopped up, a sufficiently large opening is used and, by means of a very simple mechanism fixed to the apparatus, the movement of the shaft and the arrival of the liquid are stopped once every revolution, the liquid being stopped just a little before the shaft. After a time sufficient for the product to evaporate, the mechanism sets the shaft in motion for a second revolution and allows the liquid to pass once more. Whether the apparatus works continuously or discontinuously, the final product is always exactly the same for the same temperature and degree of vacuum in the desiccator.

With this machine the author was able to concentrate large quantities of fresh grape must which have kept perfectly, without any previous sterilisation, for several years. It should be noted that owing to the intense evaporation of the liquid, the product treated is at a much lower temperature — about 20° to 26°C — while on the wall than the wall itself — 36° to 45°C.

1276 — **The Eichenberger Electric Evaporator.** — AMSTEIN, J., in the *Schweizerische Obst und Gartenbau Zeitung*, Year XXXI, No. 18, pp. 227-222 + 2 Figs. Münsingen, August 1, 1918.

Since 1917, M. E. EICHENBERGER, of Neukirch-Egnach, canton of Thurgovie, Switzerland, has made an electric evaporator for drying fruit, vegetables and other agricultural products, which has worked successfully for a year.

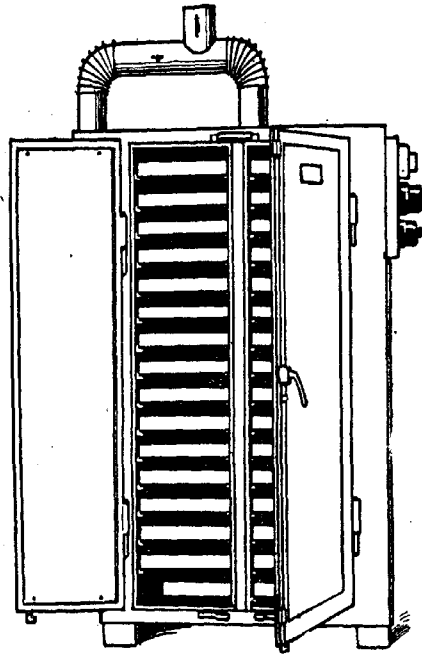
As is shown in the figure the EICHENBERGER electric evaporator is shaped like a wooden cupboard insulated with eternit and fitted with a ventilating fan driven by a weak electric current; the bottom and walls are provided with heating elements and a heat regulator.

This evaporator is made in different sizes; the small models are in sizes from 32 to 59 in. high; the model *a*, of 200 to 300 watts, can take from 6.6 to 14.2 lb. of material to be dried; model *b*, of 300 to 400 watts, can take from 14.2 to 22 lb.; model *c*, of 400 to 700 watts, from 22 to 40 lb. Their prices are 90 fr., 100 fr., and 150 fr. respectively. According to the size they take up to 16 trays.

The evaporator used by the author is the largest model, costing 1500 fr.; as shown in the figure, it contains 32 trays holding 264 lb. of apples or 154 to 220 lb. of vegetables. According to the product, from 7 to 24 hours are required to obtain the desired degree of dryness.

The author used the apparatus continuously day and night from September, 1917, to February, 1918 and later on for another 3 weeks. During all this time he dried 6600 lb. of apples, 660 lb. of prunes and from

15 200 to 17 600 lb. of various products. — french beans, celery, turnips, parsley, etc.



EICHENBERGER electric evaporator.

1277 - Review of Patents.

TILLAGE MACHINES AND IMPLEMENTS. — *Brasil*: 10217 Three furrow plough; 10218 Ridge plough for cereal cultivation.

Canada: 183565 Disc harrow; 183670 Harrow lifter.

France: 487948 Combined cultivator and hoe replacing the plough and other implements; 488287 Device for utilising Brabant and balance ploughs for motor culture by combining them with light engines; 488309 Improvements to gang ploughs towed by cable.

New Zealand: 39192 Harrow; 39561 Subsoil-draining attachment for agricultural implement.

Sweden : 43134 Agricultural implement.

United Kingdom : 117140 Soil pulverising machine ; 117150 Coupling for motor-plough ; 117169 Balance plough ; 117660-117661 Ploughs and cultivators for attachment to 2-wheeled motor-tractors ; 117766 Lifting device for ploughs or cultivators drawn by motor tractors ; 117771 Wheeled carriage for receiving beams of plough shares or cultivator tines and for attachment to a motor-tractor ; 117856 Power cultivation of land by cables.

United States : 1271031 Lister plough ; 1271373 Plough ; 1271485 Dumping scraper ; 1271818-1272231 Rotary spaders ; 1272260-1272204 Harrows ; 1272905 Tractor plough ; 1273069 Spring governor hitch for plough.

DRAINAGE AND IRRIGATION. — *Sweden* : 43242 Ditching machine.

United States : 1273206 Ditching machine.

MANURES AND MANURE DISTRIBUTORS. — *Denmark* : 23289 Fertiliser distributor.

United States : 1270849-1271007 Fertiliser dropping device.

DRILLS AND SEEDING MACHINES. — *Canada* : 183902 Potato planter.

United States : 1272550-1273251 Planters ; 1273039 Potato cutting machine.

VARIOUS CULTURAL OPERATIONS. — *Canada* : 183993 Plant protector.

Denmark : 23310 Movable spring-tines for cultivator, horse-hoe, etc.

France : 488320 Orchard plough.

United Kingdom : 117548 Stake for supporting plants.

United States : 1270787-1273496 Wheel weeder hoes ; 1270802 Riding cultivator ; 1271292 Lister cultivator ; 1271882 Attachment for maize cultivator ; 1272567 Hand cultivator.

CONTROL OF DISEASES AND PESTS OF PLANTS. — *New-Zealand* : 40019 Garden spraying apparatus.

Switzerland : 79035 Cockchafer trap.

United States : 1270847 Boll weevil catcher ; 1271355 Insect trap ; 1271504 Palmetto-root and weed plough.

REAPERS, MOWERS AND OTHER HARVESTING MACHINES. — *Canada* : 183747 Basket for lawn mowers.

Denmark : 23159 Platform for binders.

France : 488234 Motor lawn mower.

Switzerland : 78915 Mower knife control mechanism ; 79032 Sheaf packer and binder.

United Kingdom : 117137 Fruit gathering device ; 117496 Improvement to side-delivery hay-raking and swath-turning machines.

United States : 1271705 Bean harvester ; 1271803-127867 Harvesters ; 1271845 Header attachment for tractor ; 1272007 Bundle-carrier for grain binders ; 1272095 Sickle attachment ; 1272140 Grain saving attachment for binder ; 1272360 Automatic trip for shocking machine ; 1272371 Kaffir-corn header ; 1272426 Shocker attachment for binders ; 1272617 Hay-rake for mechanical traction ; 1272628 Mower and harvester attachment ; 1272665 Grain-reclaimer ; 1272666 Mechanical hay shocker ; 1272711 Cord holder for grain binder ; 1272717 Seed harvesting machine ; 1272733-1273350

Maize picking and husking machines; 1272875 Flax pulling attachment for harvesters; 1272885 Attachment for hay rake; 1273240 Maize stalk cutter and loader.

MACHINES FOR LIFTING ROOT CROPS. — *Denmark*: 23223-23307-23325-23326 Potato diggers; 23250 Root digging and topping machine; 23211 Turnip digger with elevator; 23327 Topping device for sugar beet diggers.

Sweden: 39655 Potato digger; 43016 Hand root-digger and topper.

United Kingdom: 117126 Potato digger and harvester.

United States: 1271076-1272604-1272986 Beet harvesters.

THRESHING AND WINNOWER MACHINES. — *Denmark*: 23234 Attachment for threshing machine.

United States: 1271545 Grain cleaner for threshing machine; 1272790 Grain separator for threshing machine; 1273462 Grain separator.

MACHINES AND IMPLEMENTS FOR THE PREPARATION AND STORAGE OF GRAIN, FODDER, ETC. — *Canada*: 183548 Grain loader.

Denmark: 23243 Straw-cutter.

Switzerland: 78916.

United States: 1272419 Hay and sheaf loader; 1273040 Potato loader; 1273065 Sheaf loader; 1273312 Portable loader and elevator.

FORESTRY. — *Canada*: 183296 Brush cutter; 183464 Brush cutter and stump remover.

Sweden: 43135 Stabilising device for hand saw while sawing; 43217 Hand saw spring device for felling trees.

STEERING AND TRACTION OF AGRICULTURAL MACHINERY. — *Canada*: 183518 Wind mill; 183831 Tractor.

Denmark: 23171-23179-23283 Wind mills.

France: 488228 Windlass for mechanical ploughing.

United Kingdom: 116855 Steam tractor; 117114 Endless belt traction engine; 117125-117699 Tractors; 117662 Means for attaching a motor tractor to a binder.

United States: 1270826 Motor driven vehicle; 1270991 Traction wheels; 1271239 Traction belt-chain; 1271546 One-side endless-belt tractor; 1271661 Tractor attachment for farm implements; 1272287-1272475-1272491-1273631-1273652 Tractors; 1272592 Tractor attachment; 1273035 Traction and power attachment for motor-car; 1273350 Tractor attachment for automobile; 1273470-1273519 Power transmission attachments for automobiles; 1273582 Wind mill.

FEEDING AND HOUSING LIVESTOCK. — *Denmark*: 23153 Hog self-feeder.

Sweden: 43261 Calf feeder.

United States: 1272591-1273294 Horse shoes; 1273305 Branding and dehorning squeezers for cattle.

POULTRY FARMING. — *United Kingdom*: 117329 Food for poultry, etc.

United States: 1271666 Incubator.

API CULTURE. — *United States*: 1273286 Horizontal honey extractor.

INDUSTRIES DEPENDING ON PLANT PRODUCTS. — *Brazil*: 10186 New process and device for preparing Madeira wine.

United Kingdom : 116994 Machine for stoning fruit ; 117479 Vegetable cutting and slicing machine ; 117557 Machine for filling bottles, cans, etc. ; 117582 Machine for capsuling bottles ; 117749 Machine for cutting and slicing lemons.

United States : 1271065 Baker's furnace ; 1271269 Manufacture of non-alcoholic malt beer ; 1271371 Preparation of yeast ; 1271868 Pine apple fleshing machine ; 1271914 Method of treating raw sugar juices ; 1272750 Process for preserving fruits and vegetables ; 1273120 Hemp drying rack ; 1273293 Vegetable dye and process of making same ; 1273395 Tobacco drying system and apparatus ; 1273396 Heating and drying apparatus.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS. — *Canada* : 183568 Fish drier.

United States : 1271060 Process and formula for tanning hides ; 1273662 Process of tanning.

DAIRYING. — *New-Zealand* : 33925 Milk ejector ; 39983 Skim milk tank delivery apparatus.

Sweden : 43037 Device for separator delivery tank ; 43068 Cream delivery control for centrifugal separator bowl ; 43190 Churn and centrifugal separator combined ; 43259 Improvement to a milking machine ; 43262 Churn ; 43277 Device for suction milking machine.

United Kingdom : 117307 Milking machine ; 117355 Churn ; 117557 Machine for filling bottles, cans, etc. ; 117713 Apparatus for drying milk.

United States : 1271153 Milk pasteurizer ; 1271367 Centrifugal separator ; 1271544 Vacuum milking machine ; 1273375 Method of testing milk.

FARM BUILDINGS AND EQUIPMENT. — *Canada* : 183329 Portable sheep fold and shelter.

United States : 1270879 Barn ventilator ; 1273456-1273673 Wire stretcher.

AGRICULTURAL INDUSTRIES.

1278 — *Analysis of Portuguese Colares Wines.* — GONÇALVES DE SOUSA, J. V., in the *Revista Agronomica*, Year XIII, Series 2, Nos. 1-4, pp. 90-93 + 2 Tables. Lisbon, 1908.

To distinguish the Colares type of wine (1) the author analysed 127 samples of red wine and 23 samples of white wine from these vineyards. Below are give the averages of several determinations. The first figure for each value is for red wines, the second for white wines:—

(1) Colares (or Collares) wines are fine table wines from the vine-growing district of the basin and banks of the Tago. These remarkable wines are made almost exclusively with "Ramisco" grapes, considered the finest of Portugal. They form the basis of the Colares vineyards, 20 miles from Lisbon, on the sandy shore near Cintra. — B. C. CINCIANATO DA COSTA and D. LUIZ DE CASTRO, "Le Portugal au point de vue agricole", pp. 389-394. Lisbon, 1900. (Ed.)

Alcohol. — by volume, 11.14%, 11.99%; by weight, 8.84%, 9.49%.
Total dry extract: — 23.41 gm., 18.61 gm. per litre.
Total acidity (expressed in sulphuric acid per litre): — 4.65 gm., 4.37 gm.
Fixed acidity (expressed in tartaric acid per litre): — 5.96 gm., 5.78 gm.
Volatile acidity (expressed in acetic acid per litre): — 0.95 gm., 0.93 gm.
Ash: — About 10% of the reduced dry extract:— Red wine, 2.42 gm., white wine 1.88 gm. per litre.
Phosphoric acid: — In the ash of red wine, 0.20 gm., in that of white wine, 0.175 gm.
Reducing sugar: — 1.54 gm, 0.99 gm. per litre.
Glycerine: — 6.20 gm, 6.59 gm. per litre.
Tannin: — Red wine, 0.81 gm. per litre; white wine, 0.002 gm. (it could be estimated in three samples only).
Bitartrate of potash (by BERTHELOT and FLEURIEU'S method): — 1.93 gm. 0.75 gm. per litre.
 Two tables show the results obtained for each of the 150 samples of wine analysed, and give the localities from which they came.

1279 — *A Study of the Viscosity of Various Colonial Oils*. — HEIM, F., in the *Bulletin de l'Office Colonial*, Year XI, No. 125, pp. 251-264. Melun, 1918.

The author, Director of the Colonial Production Investigation Service, reports work done by this Service. Certain colonial oils, such as castor oil, are of great value for lubricating purposes. As a rule, however, in the case of all fats, even those which are solid at normal temperature, it is necessary to ascertain whether the viscosity constants may be used to characterise and differentiate the fatty bodies. On the other hand the relation between the chemical properties of fats, their viscosity constants and other physical constants require to be defined. The study of the viscosity of latex, rubber solutions, etc. as well as of oils and fats, is of equal interest. Viscosity tests were made with a viscometer made on the same principles as that used for the study of the viscosity of solutions (1).

CONCLUSIONS. — Viscosity varies greatly with the temperature so that when viscosity determinations are being made variations in temperature should be guarded against. Comparative tests must be made at the same temperature. The viscosity of oils and fats varies with different physical properties. If oils are divided into three groups, drying, semi-drying and non-drying, the viscosity increases considerably with the density in each group. This also applies to fats.

The viscosity of an oil does not appear to depend on the solidifying point and, except in the case of very viscous oils, it increases with the point of melting or solidification of the fatty acids. In the case of fats it increases with the melting point of the fat or fatty acids.

The viscosity also varies with the chemical composition of the oil or fat and decreases as the oleic acid, i. e., liquid, content increases. It would be very interesting to mix acids or pure fatty glycerides and deter-

(1) See *Comptes rendus de l'Académie des Sciences*, July 8, 1912. (Ed.)

mine all their physical properties. The results would certainly throw much light on the complex question of the composition of oils and fats. Finally, the viscosity varies with the commercial constant known as the iodine value and, for liquid oils, is higher in proportion as this value is lower, i. e., as there are fewer liquid acids.

It should be noted that if liquid oils or fats obey fairly definite laws, this is not true of very viscous oils which sometimes behave as an oil, sometimes as a fat. More numerous experiments will make it possible to clear up this point and to confirm what is already known. In practice viscosity is not only a quality of a lubricating oil, but is also an important physical property for the industrial characterisation of colonial oils and fats.

1280 — **Oil of *Jessenia polycarpa* Nuts and *Caryodendron orinocense* Seeds, in Colombia.** — BACHARACH, A. L., (Wellcome Chemical Laboratories), in *The Analyst*, Vol. XLIII, No. 509, pp. 289-291 + 2 Tables. London, August, 1918.

In Colombia oil is extracted from the nuts of "sejen" (*Jessenia polycarpa* Karst). This oil is known locally as "aceite de sejen" (literally "oil of palm") and is said to be efficacious in chest and lung complaints. It is also used for cooking purposes. It is a pale yellow oil, with a slight fluorescence and not unpleasant smell. Analyses gave the following values: — Saponification value, 188.5; iodine value, 74.1; Hehner value, 93.8. It is seen that this oil is very similar to olive oil.

The seed of the Euphorbiaceae *Caryodendron orinocense* Karst, known in Colombia as "tacay" are eaten roasted. A chemical analysis gave the following results: — Water, 4.43 %; ash, 2.95 %; crude fibre, 2.40 %; oil (ether soluble), 53.20 %; proteins, 12.90 %. The flavour of the roasted seed is somewhat similar to that of burnt almonds, but rather more bitter.

1281 — **Note on Orange-Pip Oil.** — HEWER, D. G., in *The Analyst*, Vol. XLII, No. 497, pp. 271-273. London, August, 1917.

In marmalade factories the pips are separated by centrifugalisation. Very few attempts have been made to use them commercially though it would be easy, after drying, to extract the oil from them either by pressure or the use of solvents. By the use of petroleum ether the author extracted from the pips 37.5 % of a golden-yellow, almost odourless oil, at first only slightly bitter, but becoming more so on keeping. The oil saponifies easily and should be suitable for the manufacture of soap.

An analysis of the oil gave the following values: — Saponification value, 193.7; iodine value, 100.3; specific gravity at 15°C., 0.9208.

1282 — **On the Composition of Fruit Juices.** — THOMPSON, F., in the *Delaware Agricultural Experiment Station, Bulletin No. 119* (Annual Report, 1917), pp. 18-19. Newark, February 1, 1918.

The author has attempted to estimate the citric, malic and tartaric acids in various fruit juices by means of the rotatory power produced with ammonium acetate or molybdic acid. Good results were obtained with pure solutions of the above-mentioned acids, but they did not agree with those obtained with natural fruit juices, probably because of

the rotatory influence of other constituents of the sugars themselves and because the molybdc acid was reduced. Good results were given by the Prati method as modified by WILLAMAN for estimating citric acid. Preliminary studies of the hydrogen-ion concentrations of fruit juices at different periods of ripening gave constant results. This fact is considered as showing constant acidity. This invariability is probably necessary to allow the action of enzymes.

1283 - **The Industrial Utilisation of the Colouring Matter of Sweet Sorghum Glumes** (1). — PIÉDALLU, A., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXVII, No. 9, pp. 345-348. Paris, August 26, 1918.

Towards 1850 the presence in the stem of sweet sorghum of a colouring matter giving a red dye was reported. This dye, known as "Baden red", was not used in practice. While studying sweet sorghum flour the author was struck by the colouring capacity of the acid juices which had been used during the hydrolysis of the starch, and tested this colouring matter on various fibres both mordanted and not. He found that the colouring matter could be extracted from the crushed glumes by treating them in the autoclave, under a pressure of 2 kg. per sq. cm., with distilled water containing 1 % of sulphuric or hydrochloric acid or 2 % of sodium bisulphate.

The colouring matter dyes wool, silk, leather and cotton. The acid juice dyes wool directly and silk by boiling, giving a fine salmon colour. A fine series of shades may be obtained by mordanting and intensifying. The shades thus obtained with wool and silk are bright and full, fast and easy to apply, giving beautiful shades varying from violet to fire red with a madder tint (lilac, claret, pink, amaranth, salmon), from fawn to a rich, pure brown, from pearl grey to dark grey. This colouring matter of the glumes of sweet sorghum, as well as that of several varieties of sorghum with black glumes, could no doubt be used advantageously for industrial purposes.

1284 - **Papaine as a Coagulant for Rubber**. — *India Rubber World*, Vol. LVII, No. 5, p. 311. New York, February, 1918.

Experiments were recently undertaken by ULTÉE to determine the value of papaine as a coagulant for *Hevea* latex. An aqueous solution of this preparation proved twice as powerful as an acetic acid solution of the same concentration. The vulcanisation period of rubber thus prepared is normal, but the rubber dries very slowly.

Papaine is the dried milk sap of the papaw tree, a native of Central America and the West Indies, but now introduced into most tropical countries. Papaine acts as a rennet and is sometimes used as a substitute for pepsin in medicine.

(1) See R. Feb., 1918, No. 172; R. April, 1918, No. 467; R. Oct., 1918, No. 1075. (Ed.)

- 1285 — **The Effect of Heat on the Citric Acid Content of Milk.** — SOMMER, H. H. and HART, E. B. (Laboratory of Agricultural Chemistry of the University of Wisconsin, Madison), in *The Journal of Biological Chemistry*, Vol. XXXV, No. 2, pp. 313-318 + 3 Tables, Baltimore, August, 1918.

OBERMAIER stated that boiling decreases the citric acid content of milk. The authors made experiments on the effect of heat on this constituent of milk to determine whether the decreased citric acid of boiled milk is responsible for scurvy or Barlow's disease (1) in children on a milk diet. Many workers (FUNK, GERSTENBERGER) consider the anti-scorbutic effect of certain fruit juices to be due to their high citric acid content.

Several milk samples were heated to different temperatures by different methods, and it was observed that even prolonged boiling (in the autoclave at 15 lb. pressure for 1 hour) did not affect the citric acid content, nor does heat change the salts of this acid to an insoluble form.

- 1286 — **Method of Counting Bacteria in Raw or Pasteurised Milk.** — ALLEN, P. in *The Journal of Infectious Diseases*, Vol. XXII, No. 3, p. 245, March, 1918, reviewed in *Office international d'hygiène publique*, Vol. X, No. 7, pp. 831-853, Paris, July, 1918.

Up to the present the practical bacteriological control of milk has been almost impossible. It could only be done by the general method of isolation on plates, a tedious method requiring at least 24 hours to give a result, and therefore inapplicable in general control as it would be impossible to enforce such a delay before allowing the sale of suspected milk.

The author described in detail a rapid bacteriological method of control which should render great service. An aqueous suspension of alumina mixed with milk holds the bacteria in a tube. By centrifugalising the mixture an alumina clot is obtained containing all the bacteria free from fat and casein. The residue is spread thinly on a slide and stained. As the alumina particles have little affinity for the $\frac{1}{4}$ dilution of methylene blue stain used, the bacteria can easily be counted.

- 1287 — **A Method for Detecting Bird's Flesh in Meat Preserves.** — GAUTRELET E., in *Industrie Française de la Conserve*, Year V, No. 22, pp. 217-220, Paris, June, 1918.

It is well known that the oxygen-absorbing respiratory pigment in animal blood varies in colour with the species and according to the intensity of the bio-chemical exchanges in the organism, i. e. it is a) blue through cupric albuminoid — haemocyanin, found only in the lowest animals, b) red through ferrous albuminoid — haemoglobin, only found in a few lower animals (in the free state in the blood) and in all the higher animals in special corpuscles. As the diameter of these corpuscles exceeds that of the largest muscular capillaries it is necessary for them, in order to circulate in the blood, to become deformed to a more or less considerable extent in conformity with the intensity of the biochemical exchanges in oxidation or heat which they have to assure to the organism. In most mammals the capillary "deformity" of the corpuscles is moderate and they are called *discoids*

(1) See R. Sept., 1918, No. 952. (Ed.)

In non-cyclostomous fish, reptiles, birds, camels and pacas this capillary deformity is more marked and the corpuscles are called *elliptoids*. The different animal species which have a respiratory pigment within the corpuscles can be rapidly and clearly divided into two groups by a simple microscopic examination:— those with discoid corpuscles and those with elliptoid corpuscles.

The differentiation may be carried yet further. Haemoglobin is never exactly the same in all animal species and the crystallisations of haemin hydrochlorate derived from it are different and typical for each higher animal species. The peculiar physiological properties of the albuminoids of animal tissues make it possible to obtain all the desired solution by means of anaphylactic injections.

The differential detection of animal flesh in meat preserves is, however, a particular one because the meat has been cooked and many workers have insisted that such detection is impossible under these conditions. Nevertheless the author has done so many times by the following method:— on a slide is placed a drop of physiological serum diluted with caustic soda in proportion to the average alkalinity of the blood serum of animals in general (220 mgm. per 100 parts), a mixture is made in the serum on the surface of the slide and, after about ten minutes a direct microscopic examination (without cover glass) is made with a magnification of about 400 diameters.

By these means it is possible to observe the blood in cooked preserves in the form of an amorphous mass of dissociated haematoidin, but also in the classical form of discoid corpuscles if it is a question of mammals (cooked black pudding), or with the haematoidin mass may be recognised elliptoid corpuscles, as in the case of preserves made with bird's blood (e. g. "sanguette fricassée", made of the blood of chicken or duck fried in butter with onions), or, with the haematoidin mass are seen both discoid and elliptoid corpuscles, as in the case of mixed preserve (e. g. blood of pigs and ducks mixed).

CONCLUSION. — A microscopic examination in an alkaline serum medium makes possible a generic detection of discoid and elliptoid corpuscles in the *cooked bloods*, either when *mixed* or *separated*, of mammals and birds, thus making it possible to distinguish easily the origin of the materials used in meat preserves.

1288 — **The Yemen Coffee Trade.** — See No. 1242 of this Review.

1289 — **The Tea Trade in Indo-China.** — See No. 1243 of this Review.

1290 — **The Development and Future of the Silk Products of Indo-China.** — See No. 1264 of this Review.

PLANT DISEASES

GENERAL INFORMATION

1291 - **Measures for the Control of Locusts, in Italy.** — *Gazzetta ufficiale del Regno d'Italia*, Year 1918, No. 213, p. 2590. Rome, Sept. 9, 1918.

By the decree No. 1214 of July 14, 1918 of the Lieutenant-Governor of Italy which came into force on September 10 it was ordered that :—

Art. 1. — To art. 5 of the decree of June 26, 1913, No. 888 (1) be added the following paragraph : — " The Ministry of Agriculture may order the control of locusts. According to art. 4 no indemnity is due and no previous order or notification need be made to landowners or managers ".

Art. 2. — To art. 7 of the same law the following paragraph be added : — Half of the cost of controlling locusts shall be paid by the State which may advance the whole sum. The other half shall be divided between the Province and the invaded or threatened Communes.

When the State advances that part of the expenses incurred in the control of locusts which falls to the Province and the invaded or threatened Communes, payment shall be by the methods and guarantees mentioned in the first articles of the present decree.

The Communes may contribute by loans, the value of which is deducted from the contribution to be paid by them. They are authorised to demand the necessary aid from citizens capable of work, paying those workers whose position calls for an indemnity.

When, in spite of its obvious necessity, the Communes refuse the aid, the Prefect, on the proposition of the delegates of the Ministry of Agriculture, may pass an order to deal with it.

Art. 3. — The decree, No. 529 of June 15, 1911, is abrogated from the day on which the present decree comes into force.

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

1292 - **Root Rot of Citrus in the Oasis of Tripoli.** — LEONE, G., in *L'Agricoltura Coloniale*, Year XII, 1st Half-Year, No. 4, pp. 209-215 + 4 Figs. Florence, 1918.

During his studies on the cultivation of blood oranges ("démou") the author ascertained that root rot ("marciume radicale") of citrus trees is very common in the oasis of Tripoli, where it has existed for some time.

(1) See R. Aug., 1913, No. 995. (Ed.)

It is difficult to distinguish affected trees because the disease is already very advanced before signs of it appear on the leaves. The first symptoms are hampered growth, thin twigs, slight yellowing of the leaves, abundant flowering followed by the fall of the flowers and leaves and the partial, then total loss of all the leaves. When the roots are uncovered a strong smell of putrefaction is noticed. The roots are badly diseased, blackish in colour, and soft and spongy. The bark is easily removed, and underneath there are white layers of mycelium. In most cases the affected tree dies. The disease is contagious.

In the soil of the oasis of Tripoli strata of more or less impermeable rock are found at various depths which the roots may reach. The irrigation water may remain more or less on these strata and, as the natives irrigate citrus trees copiously, water being given in summer every five days in quantities much exceeding the needs of the plants, the author considers root rot to be caused chiefly by excess of water. The trees may be rendered subject to the disease by the excessive use of manure containing faecal matter, the rapid fermentation of which may affect the cortical tissues of the roots. This would occur especially where citrus trees are grown in conjunction with vegetables. Whatever the original cause of the root rot may be, abundant irrigation favours its development. Its rapid spread is facilitated by the system of propagation used which usually consists in layering and, more rarely, in the use of cuttings.

The most important preventative measures are:—

- 1) When propagating by cuttings, use cuttings and healthy rooted cuttings from trees unaffected by the disease. The best and safest system, however, is to use plants grafted on bitter orange trees.
- 2) If well-made manure is not available it is best to use mineral fertiliser.
- 3) The roots should not come in contact with the manure.
- 4) Irrigation should not be excessive but reduced to the absolute minimum required.
- 5) Herbaceous plants needing much moisture and organic manure, such as vegetables, should not be grown in conjunction with citrus trees.
- 6) Trees should not be replanted where there are any dead roots.
- 7) Trees should not be planted too deep.
- 8) The plantations should be constantly examined because, if the disease is discovered in its early stages, it may be controlled, in some cases at least, by isolation and care of the plants attacked.

1293 — **Disease of the Elm and Nettle Tree, Observed in Italy.** — PANTANELLI, E., in *Le Stazioni sperimentali agrarie italiane*, Vol. LI, Pt. 3-6, pp. 214-219 + 2 Plates. Modena, 1918.

In August, 1915 the author observed an apparently new disease on young elms and nettle trees (*Celtis australis*) grown uninterruptedly for several years in the Royal Nursery of Aquila. Young elms one to two years old were stunted with short, thin twigs with short internodes, and very developed secondary branches which gave the trees a bushy appearance. The

leaves were very small, covered with small, transparent, yellowish spots, irregular and of varying thickness, generally thinner in the pale areas.

The upper part of the nettle tree was chiefly attacked, and was also stunted, the internodes being short, the branches thin and the development of the secondary branches more rapid than in normal plants. The leaves too were smaller than normal ones, deformed, twisted, wrinkled, and covered with spots of a yellowish-green even in reflected light. The leaves were thinner in the pale areas. Neither on the young trunks nor on the roots was there any sign of an insect or plant parasite, or of any histological disease of these organs. The roots were few in number, little branched, but healthy.

When the stunted trees were transplanted in fresh soil the disease disappeared or diminished more easily in the nettle tree than in the elm, but the growth of the diseased plants was slight, and often they did not survive.

The author has observed in Emilia on several occasions a disease similar to that found in the nursery at Aquila, but, instead of attacking young plants, it attacks the last annual buds of adult trees. These buds are so stunted as to look like "witch's brooms". The author believes this disease to be caused by functional disturbances.

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

1294 - **Fungi of the Valley of San Martino or the Valley of Germanasca, Piedmont, Italy** (1). — PEYRONEL, B. in the *Nuovo Giornale Botanico Italiano*, New Series, Vol. XXV, No. 2, pp. 146-192. Rocca San Casciano, 1918.

This second contribution to the study of the mycological flora of the Vaudois Valleys of Piedmont gives a list of 128 species of macromycetes and micromycetes almost all of which were collected in the Ricalaretto district, mostly at altitudes above 3280 feet, during July, August and September, 1914, and August and September, 1916. Seventy-two species are new to the district, and one is new to Italy. The description of most of the species is followed by morphological and biological observations.

1295 - **Fungi from India, Malaya and Africa.** — *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 6, pp. 207-210 + 8 Figs. London, 1918.

Nine species from India, Malaya, Africa, and Australia are described in the present note, apparently as new to science.

The following species are worthy of special mention:—

- 1) *Fomes elegans* Wakefield, on living *Shorea rubusta* ("Sal") at Singbhum; this polyporus is not reported to have caused serious damage;
- 2) *F. pseudo-ferreus* Wakefield; the cause of a serious disease of the

(1) See R., February, 1917, No. 191. (Ed.)

roots of *Hevea brasiliensis* in Malaya; the disease in question was first attributed to the action of *Poria hypolateritia*; unfortunately the material available at present is imperfect and it seems that perfect fructifications are rarely formed; when well developed ones are available, the description given may have to be revised, but as the species cannot be identified as any known form, a name has been given to it in the interval;

3) *Puccinia Coreopsidis* Wakefield, on *Coreopsis*, in Uganda;

4) *Cercospora latimaculatus* Wakefield on leaves of *Bauhinia* at Aburi (Gold Coast).

1296 — On the Life History of the Rose Blotch Fungus (*Actinonema Rosae*), in Great Britain. — ALCOCK, N. L., in the *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 6, pp. 193-197 + 2 Figs + 1 Plate. London, 1918.

Work on the control of *Actinonema Rosae* (1). — which, according to WOLF does not belong to the genus *Marssonina* (2) — has till recently been hampered by lack of knowledge of its life cycle and the origin of the new attack each season. This problem was solved for the United States by WOLF (1912) who found on dead rose leaves an ascigerous stage, for which he formed the genus *Diplocarpon* (3) belonging to the family *Microthyriaceae*. The perithecia ripen in April and the ascospores formed in them infect the young foliage as it unfolds. There did not appear to be an ascigerous stage in Great Britain, where repeated investigations into this subject had always given negative results. When pruning Juliet roses in the spring of 1918 a patch of discoloured tissue, apparently caused by a fungus, was noticed on the young wood of the previous season. A microscopical examination showed these patches to contain abundant mycelium and compact masses of fungus-tissues bearing spores of *Actinonema Rosae* (4).

The season was well advanced before the infection on the young wood of Juliet was first observed. The roses in most of the gardens had already been pruned and it was no longer possible to obtain much more material or to make a complete list of the varieties affected. The fungus is scarce in the Royal Botanic Gardens, Kew, and appears to die soon if introduced into the neighbourhood. A visit to the Gardens of the Royal Horticultural Society at Wisley showed the wood of the following varieties to be attacked: — Madame Ravary, La Tosca, Mrs. David Jardine, Gruss an Teplitz, and Juliet.

It is not sufficient to collect and burn infected leaves, attention should also be given to the wood of the preceding years and, if it be infected, it should be cut. Experiments in America have also shown that dusting eight times a year with a powder composed of 90 parts of finely ground sul-

(1) See R. April 1911, No. 1294. (Ed.)

(2) See R. June, 1913, p. 879; R. Nov., 1914, No. 1073. (Ed.)

(3) See R. Dec., 1915, No. 1350. (Ed.)

(4) From 1914 onwards was observed in France in the tissues of the stem mycelium attributed to *Marssonina Rosae* and it was henceforth considered that this mycelium might be perennial. See R. Nov., 1914, No. 1073. (Ed.)

phur, and 11 parts of arsenate of lead is very effective in controlling blotch. Bordeaux mixture and lime sulphur are also satisfactory, but disfigure the plants. In badly-infected gardens it is advisable to use a fungicide even if the trees have been carefully pruned, because some pustules are almost certain to have passed unnoticed and spores may be carried from neighbouring gardens by the wind. It is most important to begin spraying early to prevent the fungus from entering the leaves because, should this occur, the mycelium continues to grow in the tissues and the blotches follow inevitably. American experiments have shown that, to protect the trees completely, it is necessary to spray at intervals of about a month.

1297 — **Specific Resistance of Different Varieties of Spring Wheat to *Fusarium culmorum* in Sweden.** — ÅKERMAN, A., in *Sveriges Utsädesförenings Tidsskrift*, Year XXVIII, Pt. 2, pp. 82-89. Malmö, 1918.

In 1917 spring wheat in South and Central Sweden suffered severely from attacks by *Fusarium culmorum*. According to the author this was due to two causes:— 1) the seed from the 1916 harvest was already badly infested by the *Fusarium* which developed in the damp, rainy weather which prevailed during the harvest; 2) the great drought of the spring of 1917 which greatly weakened the plants, thus making them more subject to disease.

Not all the varieties examined behaved in the same way. The most immune varieties were 0850 (of Sol × Svalöfs Kolben), 0841 *b* (new strain of Extra Kolben), 0810 (of Värpär × Brunt Schlanstedter). These were followed by 0805, 0821, 0821 *b* (of Värpär × Svalöfs Kolben), 0841 (Extra Kolben), Marquis, and a native spring wheat from Dalarna.

The most susceptible (judged by the number of diseased seedlings) were:— 0201 (of Emma), 0804 (of Emma × Värpär), Värpär, Svalöfs Kolben, and Halland native spring wheat.

Numerous controlled experiments confirmed these different degrees of specific resistance the causes of which are not yet known. There is no relation between earliness and the intensity of the attack. The early varieties 0880 (ripe on August 31) and the Halland wheat (August 31), suffered as much as the late varieties 0201 (September 4) and 0804 *b* (September 9). The different behaviour of the varieties may depend on the structure of the flower or the presence of substances toxic to *Fusarium*.

•1298 — **Disease-Resistant Sugar Canes, in Porto-Rico.** — See No. 1239 of this Review.
1299 — **Direct Bearers Resistant to Diseases and Pests, in France.** — See No. 1280 of this Review.

1300 — **The Influence of Pruning on the Resistance of Grafted Vines to Diseases and Pests.** — See No. 1251 of this Review.

1301 — **Copper Sulphate and Copper Products in Italy.** — See No. 1210 of this Review.

1302 — **Disinfection of Seed against *Pleospora graminea*, Injurious to Barley.** — LIND, J. and KOLPIN RAWN, F., in the *Tidsskrift for Planteavl*, Vol. XXV, Pt. 1, pp. 56-116 + Bibliography of 20 Publications. Copenhagen, 1918.

From 1908 to 1916 numerous investigations have been made in Denmark to determine the best method of disinfecting seed barley against

Pleospora graminea ("Stribesyge") which does serious damage to barley crops in the north of Europe.

If the necessary precautions are taken the best results are obtained by soaking the seeds in solutions of formaldehyde, copper sulphate and mercuric chloride. If the material is badly affected it is left in 0.2 % of formaldehyde for 6 hours, or 0.5 % of copper sulphate for 4 hours, or 0.1 % of mercuric chloride for 2 hours. If the material is only slightly affected the time of soaking may be reduced by half.

Treatment with hot water may be carried out in three ways:—

- a) soaking for five minutes in water heated to 56 or 57°C., the seeds being softened in cold water;
- b) soaking in hot water followed by the drying of the material at high temperatures — 80°C. or more;
- c) simple soaking in hot water followed by drying in the air at normal temperature.

The best results have been obtained with the last method although it is not so satisfactory as mercuric chloride, formaldehyde and copper sulphate. The appended table gives the efficiency of the different remedies by showing the decrease per cent of affected plants and the corresponding increase in the yield in grain and straw.

Treatment	Number of tests	Percentage of infected plants		Decrease in the percentage of plants infected as the result of the treatment	Percentage of increase in the yield of	
		Grains not disinfected	Grains disinfected		seed	culms
Hot water at 56-57°, followed by drying of the seed at high temperature	4	15.3	5.3	10.0	8	4
<i>Idem</i> , without drying	17	14.7	1.2	13.5	8	6
Hot water at 50-51°, after softening of the seed	11	14.9	1.0	13.9	11	6
Soaking in copper sulphate	7	18.6	3.2	15.4	13	7
Soaking in formaldehyde	8	20.9	3.4	17.5	12	9

If the treatment has no unfavourable influence on the germinating faculty or germinating energy there is for each percentage decrease in the number of plants infected an increase in yield equal to 0.6-0.8 % for seeds and 0.4 % to 0.5 % for stems.

Early sowing in cold soil favours the development of *Pleospora*. If, in this case, later sowing is impossible, disinfection of the seeds becomes more important than ever.

1304 - *Bagnisiopsis Dioscoreae* n. sp., an Ascomycete Parasitic on Yam in South Nigeria. — WAKEFIELD, E. M., in the *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 6, pp. 199-201 + 4 Figs. London, 1918.

In January, 1918, Mr. C. O. FARQUHARSON, Mycologist of the Agricultural Department, Southern Provinces, Nigeria, sent stems of a yam (*Dioscorea*) attacked by a fungus to the Royal Botanic Gardens for identification. The plant attacked was *D. prachensis* Benth. The fungus, which belongs to the family *Dothideaceae* and is described as new to science under the name of *Bagnisiopsis Dioscoreae*, is undoubtedly parasitic and the disease, although localised, is serious.

The material examined was collected at the beginning of November 1917, in the Okigwi district though the fungus had already been found on *D. prachensis* in 1911 at Oban, South Nigeria. The parasite attacks the lateral shoots which arise in the axils of normal leaves and causes marked hypertrophy. The internodes are shortened and the leaves dwarfed, and the stem appears much swollen where the elongated black stromata break through its tissues. Frequently numerous stromata occur parallel to one another so that the cortex is almost entirely replaced by fungus tissue.

1305 - *Colletotrichum linicolum* n. sp., Injurious to Flax Seedlings, in Ireland. — PETHYBRIDGE, G. H. and LAFFERTY, H. A., in *The Scientific Proceedings of the Royal Dublin Society*, Vol. XV (New Series), No. 30, pp. 359-384 + 2 Plates. Dublin, August, 1918.

Flax growers in the north of Ireland frequently complain of a disease of the seedlings which they call "yellowing". The attention of the authors was first drawn to this trouble in the early part of the summer of 1916, when diseased plants from farms in Antrim were sent to them for examination. Observations made by one of the authors during the following spring in Antrim and neighbouring counties showed the disease to be common and the cause of considerable damage to the young crop in some cases.

The principle symptoms of the disease are the development of spots on the cotyledonary leaves and lesions on the young stems, which, in many cases, cause the death of the seedling by a process resembling "damping off" (*Pythium de Baryanum*).

A species of *Colletotrichum* was found associated with the disease. This fungus was isolated and grown in pure culture. Infection experiments made with it showed it to be the cause of the disease. To some extent the disease resembles "flax canker", attributed in the United States to *Col. Lini* Bolley (1910). It resembles more closely a disease of flax in Holland, ascribed by SCHOEVERS (1915) to a species of *Colletotrichum* which, according to information supplied to the authors by BOLLEY, is the same as the fungus observed by him in America.

Under the name of *Col. linicolum*, the authors describe the fungus, proved by them to be the specific agent of the disease, as a species new to science. It was found that the mycelium of the fungus hibernates within the cells of the epidermis of the seed-coat and that the disease is transmitted by the seeds. Transmission of the disease may be largely prevented, by deep sowing so that, on germination, the seed-coats remain underground

This, however, is not a practicable method of control. The disinfection of infected seed with formalin and hydrogen peroxide greatly reduced the number of diseased plants but did not completely eliminate the disease. Treating slightly moistened infected seed with a mixture of finely powdered copper sulphate crystals and dry sodium carbonate suppressed the disease entirely.

Flax-seed from Russia, Holland, Canada, and the United States has been found to produce diseased seedlings, and the disease is believed to be widespread all over the world.

1306 - *Phoma destructiva*, a Deuteromycete Injurious to Tomatoes, in Tunis. — GUILLOCHON, I., in the *Bulletin de la Société d'Horticulture de Tunisie*, Year XVI, No. 122, pp. 131-133. Tunis, 1918.

In Tunis in a tomato crop in 1917 and in different gardens in the summer of 1918 a bacterial disease was observed which threatens to become serious if it is not controlled. The first fruits are generally sound, those which form after July being attacked. The disease first attacks the ripe fruit spreading subsequently to the green fruit. The fruit affected is first covered with very distinct spots and finally decomposes, the flesh becoming blackish and deliquescent. The disease is attributed to *Phoma destructiva* (r).

The author recommends the picking and immediate burning of all spotted fruit, whether green or ripe. At harvest time care should be taken not to leave spotted fruit on the ground as insects may visit it and propagate infection.

1307 - *Keithia Chamaecyparissi* n. sp., an Ascomycete Parasitic on the White Cedar *Chamaecyparis thyoides*, in New Jersey. U. S. A. — ADAMS, J. F., in *Transac.* Vol. XVIII, No. 8, pp. 157-160. 2 Figs. Lancaster, Pa., 1918.

A description is given of the new species, *Keithia Chamaecyparissi*, found on *Chamaecyparis thyoides*, at Lakehurst, New Jersey, in the summer of 1915 and again on June 14, 1916. The infected leaves turn brown and apothecia develop on the upper surface of the leaves as circular or elongated pustules. Infection is usually confined to the lateral leaves. On most of the dead terminal leaves *Lophodermium juniperinum* Fr., which appears more prevalent and perhaps more injurious than *K. Chamaecyparissi*, was found. It is probable that, under more favourable conditions, both these fungi may cause serious damage.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

1308 - The Coccidiidae *Pulvinaria platensis* n. sp., *P. flavescens* n. sp., and *P. minuta* n. sp., and their Natural Enemies, in Argentina. — CARIDE MASSINI, P. and BRÉTHES, J., in *Anal. de la Sociedad Rural Argentina*, Year, LIII, Vol. LII, pp. 148-158 + 10 Figs. + 8 Plates. Buenos Aires, 1918.

The following coccidiidae of the Argentine are described:—

1) *Pulvinaria platensis* Bréthes n. sp., living on *Eugenia* sp.;

(2) See R. July, 1915, No. 759. (Ed.)

- 2) *P. flavescens* Bréthes n. sp., living on lemon tree ;
- 3) *P. minuta* Bréthes n. sp., living on *Schinus dependens*.

These three coccididae have not done serious damage so far because, according to the authors, their spread is prevented by the following natural enemies, which are also described:—

- 1) *Tetrastichus caridei* Bréthes n. sp.;
- 2) *Aphicus flavidulus* Bréthes var. *caridei* Bréthes n. var. ;
- 3) *A. flavidulus* var. *nigra* Bréthes n. var. ;
- 4) *Onophilus caridei* Bréthes n. gen. and n. sp.;
- 5) *Pseudaphelinus caridei* Bréthes n. gen. and n. sp.;

The most efficient natural enemy of the three coccididae appears to be *O. Caridei*.

1309 - The Origin of the Pink Bollworm (*Pectinophora gossypiella*), Injurious to Cotton (1). — MARLATT, C. L., in *Science*, New Series, Vol. XLVIII, No. 1239, pp. 309-312. Lancaster, La., September 7, 1918.

The determination of the original habitat of the pink bollworm (*Pectinophora gossypiella* Saunders) is of great interest in relation to the present distribution of this insect and may be of importance later as indicating where parasitic or other natural checks may be found.

A scrutiny of the records gives strong support to the theory that this insect originated in Southern Asia, probably India. This is in opposition to the theory of J. H. DURRANT (1912) who asserts that the microlepidopteron may be of American or Egyptian origin, as well as to that of A. BUSCK (1917) (2), who considers that the original habitat of the insect is Africa.

1310 - The Fennec Fox (*Canis zerda*), Useful for Destroying Injurious Insects. — See No. 1266 of this Review.

1311 - Control of Locusts in Capitanata in 1917. — PAOLI, G., in the *Bollettino dei Ministeri per l'Agricoltura e per l'Industria, il Commercio e il Lavoro*, Year XVI (1917), Vol. II, Ser. B., Pt. 5-6, pp. 1-5 of Reprint + 1 map. Rome, 1918.

This paper is a report of the measures taken against locusts in the province of Foggia in 1917, under the direction of the author, Control Commissioner in the Capitanata. As the information supplied by the inhabitants was both insufficient and unreliable, thus making it impossible to establish the localities in which the locusts had laid their eggs the year before (1916), the plan of collecting the egg-nests had to be given up and preparations made to destroy the locusts as soon as they hatched. The locusts occurred in the communes of Foggia (*Deciostaurus maroccanus*), of Ascoli Satriano (*D. maroccanus*) and Castelnuovo della Daunia (particularly *Calliptamus*, *Edipoda* and *Stenobothrus*; no *D. maroccanus*). The insects were most numerous in the first of these communes, propagating even in the neighbouring communes of Lucera and Troia. Hatching was

(1) See R., Sept., 1907, No. 879; R., Aug., 1908, No. 865. — (2) See R. Sept., 1917, No. 879 (Ed.)

first reported on May 5 and 11 from the communes of Foggia and Ascoli Satriano.

In the commune of Foggia action was taken immediately, sprayings with 5 % cresosol emulsion in water being increased to 6, 7 and 7.50 % as the insects grew older. At the same time women caught the locusts in cloths. When the cresosol supply ran out sprayings were made with 1, 2 or 3 % sodium arsenite according to circumstances. On account of the enormous number of locusts everywhere it was not possible to spray in all the places necessary because water could not always be found at a convenient distance, and the amount for each band of workers had to be carefully calculated; it was also sometimes impossible to form further bands of workers. As an experiment it was, therefore, proposed to spread bran moistened with 3% dry weight sodium arsenite on the infected soil. The result was absolutely astonishing.

On the whole little damage was done in the commune of Foggia by locusts in the pupal stage. Only a few ears of wheat, low and badly developed, were eaten and cut. In some places large numbers of the insects attached themselves to culms, thus bending them and causing part of the crop to lodge, but without doing harm. Oats suffered most, the locusts gnawing the peduncles at the base of the spikes and causing the caryopses to fall. In a vineyard, the vines of one plot were completely stripped of their leaves.

In spite of the numbers killed by these precautions the locusts continued to increase and reached the adult stage. Spraying with arsenite of soda and the use of poisoned bran were continued for some time. On June 23, when the insects took their flight, the work was stopped. Immense winged clouds fell with great voracity on the vines and other plants — the cereals were already harvested and shocked — and some vineyards suffered severely though the area damaged was limited. The damage is caused by the locusts' eating the petiole, and causing the leaves to fall. In this way vines, olive, almond, fig and wild pear trees, etc., were stripped of their leaves.

In the commune of Foggia laying began about 48 days after the first eggs hatched. An observation service was then begun to note exactly where the eggs were laid. In spite of the millions of locusts destroyed by the various methods of control an enormous number laid their eggs everywhere. According to data collected in the commune of Foggia the total area over which eggs were laid was 2224 acres; in one locality (Posta Corona) nearly 2400 nests were found in 1 sq. yard.

In the Ascoli Satriano district, where there were not very many locusts, control measures were carried out from May 13 to June 9 with cresosol and sodium arsenite sprayings and cloths. The locusts may be said to have been completely destroyed there.

In the commune of Castelnuovo della Daunia spraying with sodium arsenite was carried out from June 27 to July 5 on a small scale only because of the few locusts.

The results of the author's 1917 experiments show that cloths are of use when the locusts are young and few in number or to prevent their en-

tering a kitchen garden or other small crop, but are absolutely inefficient against large attacks. Cresosol is much more satisfactory if used by capable workmen, otherwise the locusts escape before the mixture reaches them. Cresosol, like all other insecticides with a basis of tar oil, petroleum, etc., spoils the rubber tubing and internal rubber pieces of the pumps. During the experiments no waxed tubes were available and even the leather of pumps with leather pistons was acted on by the tar. Sodium arsenite is more easy to use when attempts are not made to reach the insects directly but to soak with poison the grass on which they feed. The pumps are not destroyed more than normally and the work is easier and does not require special skill. Continual use of arsenite, however, causes burns and inflammations not easy to avoid. Both with cresosol emulsion and sodium arsenite solution abundant water and labour are required, which are not always available locally.

The use of bran or a singular poisoned substance removes many difficulties and gives excellent results. This is the method which should be most generally adopted after as many egg-nests as possible have been destroyed either by collecting them or by superficial turning of the soil so as to destroy as many eggs as possible before they hatch.

The reasons in favour of poisoned bran are :—

1) it may be prepared in one centre, in the present case, Foggia; it would be useful to investigate the possibility of preparing it mechanically instead of by hand, as was done in 1917, by using a kneading machine, olive mill, or similar apparatus, taking of course, all due precautions; this would save part of the labour;

2) no special skill is required to apply it, it is done by hand, but could be done by machine, with a sieve or a manure spreader; further labour would thus be saved; the farmers themselves could take the poisoned bran direct from the store and spread it over their land or round threatened crops, thus decreasing the expenses;

3) mechanical preparation would eliminate the troubles produced on the workmen's bodies by the prolonged use of sodium arsenite.

1312 — Influence of the Date of Earing on Damage Done to Spring Wheat by the Dip-
teron *Contarinia tritici*, in Sweden. — ÅKERMAN, Å., in *Sveriges Utsädesföretags Tidskrift*, Year XXVIII, Pt. 2, pp. 90-93. Malmö, 1918.

During the summer of 1917 larvae of *Contarinia tritici* ("Vetemyggan") caused considerable damage to spring wheat in Sweden by the destruction of a large number of the flowers. An examination of abundant material showed different varieties of wheats to behave differently.

VARIETIES SUFFERING MOST: — 0821 (of Varpal × Svalöfs Kolben), Svalöfs Kolben, Marquis, 0880 (of Svalöfs Kolben × Dala), Dala, and Halland wheat. In all these varieties the date of the beginning of earing coincides with the moment when most of the female insects are about to lay.

VARIETIES SUFFERING LEAST: — 0804 and 0805 (of 0261 × Vårpål), 0810 (of Brunt Schlanstedter × Vårpål), and 0850 (of Sol × Svalöfs Kolben).

All these varieties ear later than the preceding ones, when there are far fewer female insects.

To estimate the extent of the damage several ears of different varieties chosen haphazard here and there were examined. Of a total of 61 145 flowers 3360 (5 %) were destroyed. Considering the average yield to be 15.93 cwt. per acre, the loss due to *C. tritici* is approximately 90 lb. per acre.

1313 - *Cicadula sexnotata*, a Hemipteron Injurious to Wheat, Oats and Barley, in Sweden. — ELLINGER, T., in *Vort Landbrug*, Year XXXVII, No. 40, pp. 453-454. Copenhagen, 1908.

During the summer of 1918 *Cicadula sexnotata* ("Dvaergerikade") caused serious damage to wheat in the province of Östergötland and spread in Southern Sweden as far as Scania where, however, its attacks were not serious.

The females lay their eggs on the seedling plants and so alter their growth that they sometimes completely prevent seed-formation. The parasite can pass from winter wheat to spring-sown oats and barley, causing similar injury. The damage caused is related to the variety of wheat or other cereal, to the dates of sowing and emergence of the young plants.

The local wheat and the selected variety "Pudel" are highly resistant. The variety "Thule", obtained by NILSSON-EHLE by crossing the local wheat and Pudel, is also distinguished by its resistance.

Early sowing at the beginning of September causes the phase when the young plants emerge to coincide with the moment when the female insects are most numerous. This coincidence is avoided when sowing, owing to rain or other reasons, is retarded and the intensity of the attack is then much diminished.

1314 - Mite Disease of Potato, in Hawaii. — CARPENTER, C. W., in *Phytopathology*, Vol. VIII, No. 6, pp. 286-287 + 1 Plate. Baltimore, Md., June, 1918.

A new potato disease was observed for the first time in May, 1917, near Honolulu and Castner, Island of Oahu. It was subsequently found to be present and destructive in all the potato-growing districts of the Islands and is now considered of great importance. When there is a minimum rainfall, whether the plants be irrigated or not, they frequently dry up and die from the growing tip downwards. The small young leaves, both terminal and axillary, become bronzed on the lower surface, twist and curl upon the longer axis. Both the leaves and shoots become abnormally hirsute, dry up, and die. Often the plants grow well until about the time of flowering before being attacked. The yield of the diseased plants is naturally negligible.

Young parts of diseased plants examined with a hand lens were found to be covered with myriads of tiny mites, as yet undetermined, but probably belonging to the family *Tetranychidae*. It is to this insect that the disease must be attributed.

Tomato plants growing under the same climatic conditions were also attacked by a mite which appears similar to that attacking potatoes. It

has not yet been determined whether this disease is as serious in the tomato as in the potato.

When potato crops are attacked by the mite only, experiments have shown good results to be obtained by spraying with lime sulphur, or dusting with dry sulphur. It is advisable to plant lowland crops in autumn or winter so that they may ripen before the dry season begins.

1315 - *Gelechia ocellata*, a Microlepidopteron Injurious to the Beet, New for Italy. — DEL GUERCIO, G., in *L'Agricoltura Coloniale*, Year XII, 1st. Half-Year, No. 4, pp. 216-230 + 5 Figs. Florence, 1908.

Description of the life history of *Gelechia ocellata* Boisd., followed by preliminary notes on its biology.

This microlepidopteron was recorded for the first time in Italy by the author during the summer of 1917 in the lower Valdarno, near Florence, and was noted to be a pest of the beet. In July, the freshly-hatched larvae begin to feed on the most tender leaves of the beet. It soon reaches the root by tunneling and finally leaves the plant and completes its life cycle.

Owing to the attack of the insect, the beet foliage withers while the development of the root is more or less stopped.

The larvae of the pest sometimes contain those of an endophagous dipteran, probably belonging to the genus *Masicera*. Various means of control have been tried and arsenical solutions seem to promise good results in the control of the larvae of *Gelechia*. At the same time they help to control a fungus (*Cercospora beticola*) and some coleoptera (*Cassida*) which, in Tuscany and other regions, seriously damage the beet.

INJURIOUS VERTEBRATES.

1316 - The Preparation of Active Virus Against Field Mice and Method of Applying it in Fields Infested by these Rodents. — MORI, N., in the *Annali della Stazione sperimentale per le malattie del bestiame*, Vol. IV (1917), [abstract], pp. 1-22. Naples, 1918.

Of the various methods of controlling field mice that which, since LÖFFLER's experiments in Greece (1893) and DANYSZ's in France (1903), has proved most efficient is the application of pathogenic bacteria in the fields with the aim of causing epizootics among the rodents.

LÖFFLER used *Bacillus typhi murium*, isolated from an infectious disease which broke out among the white rats of his laboratory. DANYSZ used a bacterium isolated during a natural epizooty among field mice and known to be also pathogenic to rats. Other workers subsequently studied bacteria related to those isolated by LÖFFLER and DANYSZ. They may all be considered as belonging to the *B. enteriditis* Gärtner group, according to the classification of LEHMANN and NEUMANN. The most important of them — used in infested fields as well as to destroy rats as a preventative measure against bubonic plague — are :—

[1314-1316]

B. typhi spermophilorum, isolated by MERESHKOWSKY during an epizooty among *Spermophilus musicus* ;

LASER's bacillus, from *Mus agrarius* Pallas ;

ISSATSCHENKO's bacillus, isolated during an epizooty among white rats ;

TRAUTMANN's bacillus, causing a fatal infectious disease among grey rats ;

NEUMANN's bacillus, known to be very pathogenic to rats ; isolated from the urine of a child suffering from cystitis ;

B. septicaemiae murium Grimm, pathogenic to rats.

Other workers have isolated other bacteria of this group which have been put on the market under more or less appropriate names. In 1916 SPENDORE isolated from field mice in Apulia a bacterium which he stated to be the cause of a fatal epizooty (1).

The same year the author also observed a natural infection of field mice caused by *Bacterium murisepticum* (Flügge) Mig. (2).

At Foggia the author made laboratory experiments on field mice (*Pitymys savii* and *Apodemus sylvaticus dichrurus*) with a view to using them ventually in infested fields, with two bacteria of the *B. enteritidis* group — *B. calicida* Mori, the agent of an epizooty of cats studied in 1903, and *B. enteritidis bubalorum* Mori, isolated in 1903, from buffaloes. The results obtained were not very different from those obtained with other bacteria of the same group.

The author further studied the results obtained with haemorrhagic septicaemia bacteria and obtained very good laboratory results with *B. bubalsepticus*, *B. bovisepiticus*, *B. suisepiticus* and *B. avisepticus*. Good field results were also obtained with *B. suisepiticus*.

There is much difference in opinion as to the efficacy of virus in controlling field mice and preventing the spreading of plague by rats. Failure must not always be ascribed solely to the kind of virus used, to the more or less rational method of preparing it, the preservation of its virulence or the method of applying it in the fields. In preparing active virus against rodents choice must be made of the bacterium best suited to the purpose unless a microorganism causing a natural epizooty among the rodents to be controlled and possessing the necessary virulence has recently been isolated. The bacterium isolated must be made virulent to the species against which it is to be used by keeping the experimental animals under conditions as natural as possible, as captivity, by weakening them, may influence the results. When a good virus has been obtained it should be kept so that its virulence will neither disappear nor decrease. It must be applied to the fields rationally. To do this it is necessary to know, not only the biology of the infesting bacterium, but also that of the field mice which has hitherto been too neglected. The virus must be applied to the fields at a suitable period and hour in order to give the best results.

The author then studies the choice of bacterium, the keeping of mice

(1) See *R. Sept.*, 1916, No. 1056; *R.*, April, 1917, No. 396. (Ed.)

(2) See *R.*, Oct., 1918, No. 1187. (Ed.)

in the laboratory for the preparation of the virus, the preparation of the virus, the preservation of the virulence of the bacterium in the laboratory, the choice of media in which to distribute virus to those requiring it, and the method of applying the virus in mice-infested fields.

1317 - Susceptibility of Field Mice in Apulia to Certain Microorganisms Used to Control these Rodents in the Fields. — MORI, N., in the *Annali della Stazione sperimentale per le malattie infettive del bestiame*, Vol. IV (1917), pp. 3-51 of reprint. Naples, 1918.

The experiments made by the author in Apulia in 1910 showed that field mice (*Pitymys savii* and *Apodemus sylvaticus dichrurus*) are susceptible to all the bacteria tested, i. e., those of the *Bacillus enteritidis* group, according to the classification of LEHMANN and NEUMANN, *B. typhi murium* (Löffler, Benn stock), *B. typhi murium* (Danysz stock), *B. typhi spermophilorum* (Mereshkowsky stock), *B. cativida* (Mori), *B. enteritidis bubulorum* (Mori) and, of the hemorrhagic septicemia group, *B. bubalisepeticus* (Oreste and Armanni), *B. bovisepeticus* (Galtier, Lignières), *B. suisepeticus* (Löffler), *B. avisepeticus* (Perroncito, Pasteur). These bacteria cause the death of the rodents if administered endotheracically, endoperitoneally or subcutaneously.

Even if these bacteria are previously activated by sub-cutaneous, endotheracic or endoperitoneal passage they do not cause the death of the rodents if the cultures are administered by the digestive tract. If, however, the gastric juice be first neutralised, the same cultures may prove fatal to 100 % of the animals to which they are administered either directly or in their food. After a first passage through the digestive tract, the gastric juice having been previously neutralised, the bacteria re-isolated from the heart and grown in broth are fatal to 100 % of the rodents whether administered by the same method or without any previous treatment. Successive passages through the digestive tract may so weaken the bacteria as to render them inactive.

Experiments with *B. typhi muricum* showed that six passages through the peritoneum of *Pitymys savii* sufficed to make the bacteria inoculated through the peritoneum lose their virulence, whereas seven passages through *Apodemus sylvaticus* greatly activated it. Alternate peritoneal inoculations of the two animals gave, after four passages, a virus very active to both, killing 100 % of caged rodents when administered through the digestive tract. The ingestion of infected carrion caused death more rapidly than ingestion of virulent cultures. Field mice may infect other rodents if kept together with them.

All the bacteria examined, no matter by which method they are introduced into the mice, may be re-isolated pure from the heart if the *post mortem* is made soon after death. A period of 4 to 10 days elapses between the administration by ingestion of bacteria of the *B. enteritidis* group accustomed to infect by this method, and death. The virus from the Danysz stock has the most rapid effect (4 to 5 days). In the case of bacteria of the hemorrhagic septicemia group tested the period between infection and death varied from about 15 to 36 hours.

[1316-1317]

1318 - The Biological Control of Field Mice (1). — SPLENDORE, A., in *Bollettino del Ministero per l'Agricoltura*, Series B, pp. 1-10 of reprint. Rome, 1918.

By order of the Ministry of Agriculture the author has made since 1916 a study of diseases of field mice and, incidentally, of related forms, with the aim of using natural diseases of these rodents in controlling them. He found that these animals are naturally subject to various diseases. Amongst these must be mentioned first of all those caused by certain bacteria new to science:—

- 1) *Bacterium pitymysi*, found in *Pitymys savii* from the Contessa district, near Cerignola, province of Foggia.
- 2) *Bact. pitymysi II*, in individuals of the same rodent from different localities in Apulia;
- 3) *Bact. pitymysi III*, in *P. savii* from Torremaggiore, Foggia.
- 4) *Bact. pitymysi IV*, in individuals of the same rodent from the same locality.

5) *Bact. muris*, in two specimens of *Mus sylvaticus* from the Cerignola district.

6) *Bact. microti*, isolated from *Microtus arvalis* sent from different districts of the Carso.

7) A bacterium which appears to belong to the family *Bacillus typhi murium* Löffler, found in white rats bought at Rome.

Amongst the diseases of non-bacterial origin found in *P. savii* from the Capitanata are:—

1) An ERUPTION behind the ears causing the skin to peel easily, believed by the author to be the disease commonly known as "russa"; no specific bacterial agent was found.

2) ECTOPARASITES:— fleas probably belonging to the genera *Ceratophyllus*, *Typhlopsylla*, and *Hystriophylla*; lice, which may be placed in the genus *Haemotopinus*, are continually found in large numbers on field mice; a mite of the family *Gamasidae*, rare on adult field mice.

3) WORMS, including certain cestodes of the genus *Hymenolepis*, frequently found in the small intestines of the rodents. Other cestodes have been found in the larval state in the sub-cutaneous tissue, the pleural cavity, the peritoneal cavity and the parenchyma of the liver, in *P. savii*. With the exception of a single specimen of acanthocephalus (*Gigantorhynchus moniliformis*?) in the small intestine of one *P. savii*, only a very small nematode (*Oxyuris*?) was found in the caecum of field mice, and this only in a very few cases.

4) PROTOZOA: a *Hexamitus* near the duodenum; a *Megastoma* throughout the small intestine; a *Trichomonas* in the large intestine; a haemogregarine is sometimes found, the schizogony of which occurs mostly in the lungs, which the author believes represents a species new to science, called by him *Hepatozoon pitymysi*; in three cases was found a sarcosporidium

(*) See R. Sept., 1916, No. 1059; R. April, 1917, No. 396; R. Oct., 1918, No. 1187; (Ed.)

believed by the author to be a species new to science called temporarily *Sarcocystis pitomyssi*.

5) FUNGI. In a group of *P. savii* from the province of Salerno the author observed a disease, usually in the respiratory organs, which was undoubtedly caused by parasitic fungi. The cultural experiments made so far have shown the presence of an *Aspergillus* frequently accompanied by a *Penicillium*.

Of all the the diseases mentioned those caused by bacteria are the most likely to produce spontaneous epidemics in field mice. These spontaneous diseases are not rare, and if it be considered that they are fatal and sometimes epizootic — they are contagious and may be transmitted by fleas — the disappearance of field mice so often observed when they occur in large numbers, may be attributed to them as the conditions for spreading contagious diseases are then most favourable.

The best method of spreading these diseases is to send out field mice infected with the virus by sub-cutaneous inoculation. This system is similar to that occurring in nature and is usually certain to succeed. Virus from naturally infected mice is preferable to that obtained artificially by laboratory cultures because, as a rule, the material from natural infection is more virulent than that obtained experimentally.

It is not rare to find in fields, mice which have died naturally. Apart from a microscopic examination, it is easy to determine whether death is due to one of the above-mentioned bacterial infections for, should this be so, the spleen is large and brown. To obtain infected material for use it is sufficient to collect, with the necessary care, the spleen or liver of dead mice and use them while they are still in a good state of preservation. To prepare the inoculations the material is separated with sterilised pinces in salt water (0.80%) which has been previously boiled and cooled. Two drops of the emulsion thus obtained are inoculated into each mouse, which is then let loose in the field to carry the infection. This method is perfectly harmless to man and all useful animals and may be carried out by any careful person, even the farmers themselves, though it is best that it should be controlled and directed by a bacteriologist. In the absence of naturally infected material animals infected in the laboratory might be used.

The disease could be spread by introducing infected mice into a freshly dug hole in the field. It is not necessary to do this in all the newly-dug holes of the district as infection within a limited area is sufficient. As the infection increases these areas become centres from which the disease spreads over the whole district infected. A few days after the infected mice have been let loose careful observations are made to see if there are still many rodents. If so a second lot of mice are affected with fresh virus to make success more probable.

Infected field mice give better results than infected material. Isolated mice set free in newly-dug holes will certainly come in contact with other mice and infect them, whereas it is never certain that material placed on the ground will be found and eaten by the mice, especially if plants and other food are plentiful at the time. This system is also economical, requiring

neither a large outfit nor a large staff. If the virus is obtained it is only necessary to catch the mice, and this may easily be done by means of traps.

It may be assumed that during winter conditions are not very favourable to propagation. Fleas are rare on the mice which themselves are scattered, living in families, more or less far from each other, and rarely leaving their holes, living on stocks collected in summer. In this case it is best to introduce the disease directly into each family, either by introducing an inoculated field mouse or by placing a few grains of oats soaked in bacterial cultures into each hole.

[1318]

RUGGERI ALFREDO, *gerente responsabile.*